Vol. 37 Toronto, December 5, 1923 No. 49

Contract Record and Engineering Review

University of Toronto Library Queens Park

There is a Reason

justifying the transportation of lumber across the continent for constructing wood stave penstocks.

It is based on low annual charges due to long life and excellence of material.

B. C. (Douglas) Fir Pipe, installed on Atlantic Coast

Wire Wound Wood Pipe

Steam Pipe Casing

Tanks for all purposes

Conduit

120" Diam. Wood Pipe, Nova Scotia

Pacific Coast Pipe Co., Limited

1551 Granville Street - - Vancouver, B.C.

Alphabetical Index to Advertisers Page 16 Classified Directory to Advertisements Page 6

Announcement

BABCOCK & WILCOX, LIMITED,
of LONDON, ENG.,
The GOLDIE & McCULLOCH CO.,
LIMITED, of GALT, ONT.
and
THE BABCOCK & WILCOX CO.,
of NEW YORK
wish to announce the formation of a new Company known as

BABCOCK-WILCOX & GOLDIE-McCULLOCH, LIMITED

for the manufacture of Steam Power Plant Equipment and Accessories, with Head Office and Works at Galt, Ont. The constituent Companies desire to extend to their clients grateful thanks and appreciation of the confidence extended to them in the past and express the hope that the new Company will continue to deserve and receive it in the future.

THE GOLDIE & McCULLOCH COMPANY, LIMITED

will continue in business as manufacturers of Safes, Vault Doors, Vault Linings, Safety Deposit Boxes, etc., with Head Office and Works at Galt, Ontario.

Galt, Ontario
November, 1923

Concrete Blocks, Brick and Culvert and Sewer Tile

are staple articles. Thousands of contractors who operate their own plants have found this the most profitable branch of their business. It provides work for their men during winter months and will provide a source of income the year around.

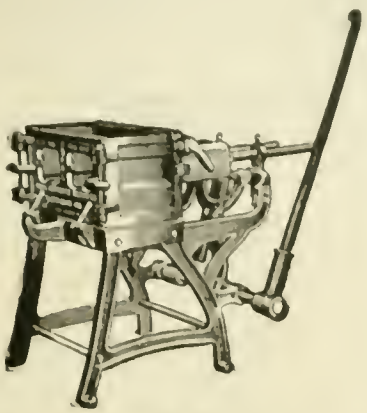


Fig. 910

IDEAL CONCRETE BLOCK MACHINES
THE WORLD'S STANDARD

The Ideal Concrete Block Machines stand supreme the world over, and the Ideal Concrete Blocks are accepted as the standard for Concrete Block Construction by Engineers everywhere.

The Ideal Block Machine makes every style of block required.

—Fully described in Catalogue No. Z2-B-1

The Ideal Concrete Block stands supreme the world over. They are made in any size, shape or design to suit the most exacting Architect or Engineer. One of the most recent developments is that of making blocks to receive stucco finish, which is very popular in house construction.

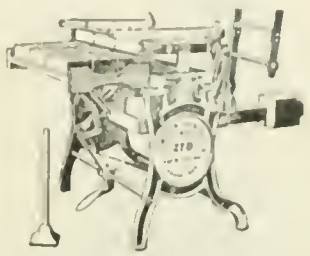


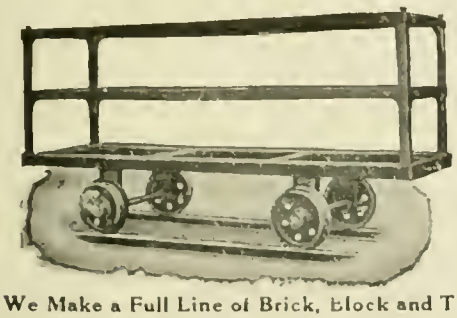
Fig. 91

LONDON CEMENT BRICK MACHINE
Hand Power

Capacity, 5,000 bricks per day. Makes brick with smooth faces on all sides and with frog impression. This is the best hand-operated cement brick machine on the market. Brick can be made on the ground where building is to be erected. There are big profits in the manufacture of Cement Brick.

—Described in Catalogue U.

Cement Brick are in good demand in many localities where building materials are required. They are suitable for all classes of construction and can be profitably made without a large expenditure.



We Make a Full Line of Brick, Block and Tile Cars. Prices on Application

—Fully described in Bulletin No. 17

London Tile and Sewer Pipe Moulds have been used to make concrete tile for every large Municipal Sewer contract in Canada within recent years. They make tile in all sizes from 4 inches up to 10 feet in diameter.

LONDON CULVERT TILE AND SEWER-PIPE MOULDS

Made in all Sizes From 4 in. to 72 in.

Our moulds are made on designs approved by Engineers. There are large profits in making Culvert Tile and Sewer Pipe.

—Described in Bulletin P-1.

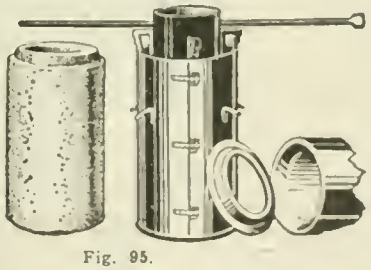


Fig. 95.

Made in Canada

We manufacture Concrete Mixers, Hoists, Air Compressors, Pumps, Brick, Block and Tile Machines, Barrows, Carts, Silo Moulds, Ornamental Moulds and Tools.

The London Concrete Machinery Co., Limited

Dept. 7, London, Canada

World's Largest Manufacturers of Concrete Machinery

Sales Offices and Warehouses:

R. R. Power, Halifax, N. S.
T. McAvity & Son, St. John, N.B.
Rene Talbot, Quebec, Que.
O. E. Barnard, Sherbrooke, Que.
Foss Machinery Limited, Montreal
Harvard Turnbull & Co., Toronto
General Supply Co. of Canada, Ottawa
J. E. Middleditch, Windsor, Ont.
E. A. Muir, Port Arthur, Ont.
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Gorman's Limited, Calgary and Edmonton
MacKenzie Supply Co., Regina, Sask
Building Products & Fuel Ltd., Saskatoon, Sask.
C. T. Nelson, Victoria, B.C.
B. C. Equipment Co., Vancouver
Whitelock & Mallett, Moose Jaw, Sask
West Kootenay Equipment & Construction Co., Nelson, B. C.

McCRACKEN SEWER PIPE
Is Winning Canada's Favor

H·W·Patterson
Engineer
Walkerville & Ford
Says—

"Walkerville, Ontario, March 5th, 1923.

Mr. W. I. Newmarch,
John E. Russell Co. Ltd.,
Harbor Administration Bldg., Toronto, Ont.
Dear Sir:

We laid three miles of McCracken Pipe twenty-four inches to six inches in 1920. Combined sewers are in excellent condition. We are using one line as outlet for centrifugal lino pump, three-inch discharge. We consider McCracken Pipe satisfactory for combined sewers, and will be calling upon you shortly for four miles additional pipe.

H. W. PATTERSON,
Engineer, Walkerville and Ford."

McCRACKEN Concrete Sewer Pipe has proved its case in Canada. Experienced engineers in all parts of the Dominion are giving it their hearty endorsement.

This widespread popularity is partly because McCracken Concrete Sewer Pipe is manufactured in accordance with standard specifications issued by the American Society for Testing Materials, and inspected by the Canadian Inspection and Testing Company Limited. And of equal importance—engineers recognize the great advantage of the uniform high quality of this pipe. They know that they can depend on every foot they buy.

McCRACKEN
SEWER PIPE
The Pipe That Endures"

JNO. E. RUSSELL CO., LIMITED
GENERAL SALES AGENTS
Harbor Administration Building, Toronto

"Every man in business has to go over a hard road and find out its turnings for himself. But he need not go over his road in the dark if he can take with him the light of other men's experience." — *John Wanamaker*

Your own way can be seen clearly, by "the light of other men's expERIEnce"

The man who has steam shovel or crane work does not need to stumble in the dark. Others have lighted the way for him.

HUNDREDS of contractors have written letters like this: "The ERIE is far superior in every way— there is no other shovel that can equal it for reliable service and low upkeep cost."— *R. C. Myers, Strange-Maguire Co., Salt Lake City, Utah. (They have 2 ERIES.)*

Contractors who have compared different makes of steam shovels report that their ERIES cost only ⅓ as much to keep up— WITH A CORRESPONDING SAVING IN WORKING TIME.

You will find conclusive proof of this in our new 72-page book: "Upkeep Costs and Output Records of ERIE Shovels." Actual records of 48 ERIES on various kinds of work— write for Bulletin S-70.

ERIE STEAM SHOVEL CO., Erie, Pa., U. S. A.
Incorporated 1883 : formerly BALL ENGINE CO
Builders of ERIE Steam Shovels, Locomotive Cranes, Pa[illegible] way D[illegible]

ERIE Revolving Shovels

Branch Offices
Boston, New York, Phila[illegible]
Pittsburgh, Atla[illegible], Chi[illegible]
Representatives throu[illegible] the U. S. A.

CLASSIFIED INDEX TO ADVERTISEMENTS

The following regulations apply to all advertisers:—Eighth page, every issue, three headings; quarter page, six headings; half page, twelve headings; full page, twenty-four headings

Acid Proof Fans
Canadian Blower & Forge Co.
Sturtevant, B. F. & Co.

Air Compressors
Canadian Ingersoll-Rand Co.

Air Washers
Canadian Blower & Forge Co.
Sturtevant, B. F. & Co.

Aluminum
Spielman Agencies Regd.

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Canadian Welding Works
Northern Architectural Iron Works
Canada Wire & Iron Goods Co
McGregor & McIntyre
Meldrum Iron Works Ltd.

Air Hoists
Canadian Ingersoll-Rand Co.
Inglis Co., John

Ash Hoists
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Jeffrey Manufacturing Co.

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Conduits (Wooden Pressure Creosoted
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Canadian Blower & Forge Co.
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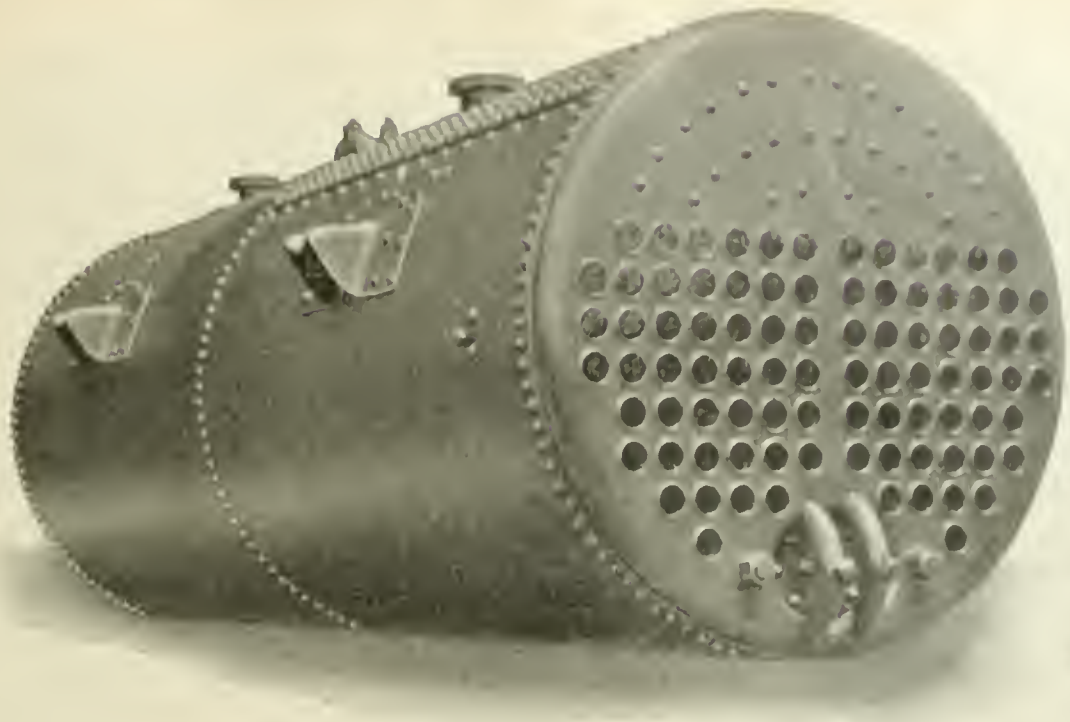
(Continued on page 8)



When you need a new Boiler let this plant show you what it can do

With our 35 years' experience, we are able to turn out Boilers of latest design, of all types, at low first cost, of high efficiency and long service records with minimum stoppages for repairs.

The construction is carried out with scrupulous care at every step. All rivet holes are accurately laid out—no drift pins being used. Caulking edges are neatly bevelled and all seams thoroughly caulked. Tube holes in heads are accurately machine-cut and edges carefully chamfered. All tubes are expanded and beaded over at both ends. On completion, all boilers are tested to at least one and a half times their working pressure before leaving our works. We equip our Boilers or sell as a separate unit the popular National Hand Fired Stoker which gives you the efficiency of the large mechanical Stokers at a fraction of the cost.

We build to suit the Interprovincial Boiler Code and we can ship economically by rail or water. Let us show you what we can do for you.

We build Horizontal Return Tubular, Vertical Tubular, Locomotive Type and Marine Boilers. We construct Tanks, Penstocks and Steel Plate work of all kinds. We furnish gray iron and brass castings of any size in the rough or machined to order.

Engineering & Machine Works of Canada, Ltd.

ST. CATHARINES, ONT.

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Winnipeg Agents: Powell Equipment Company, Limited. Vancouver Agents: M. Grindley Co.

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Sturtevant, B. F & Co.

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Spielman Agencies Regd.

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Canadian Blower & Forge Co.
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Clyde Iron Works Sales Co.
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Mussens Limited

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Koehring Co., of Canada
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Canadian Austin Machinery
Canadian Equipment Co.
Hopkins & Co., Ltd., F. H.
MacKinnon Steel Company
Mussens Limited

Inspection Engineers
Canadian Inspection & Testing Laboratories
Hunt & Co., Robt. W.
Milton Hersey Company

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Dom. Tar & Chemical Co., Ltd.
Imperial Oil Company, Ltd.
Spielman Agencies Regd.
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Dominion Bridge Co., Ltd.
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Kilns
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Dominion Bridge Co., Ltd.
MacKinnon Steel Company

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American Lead Pencil Co.

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Muldoon, Ltd., J.
Standard Lime Co.

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Canada Wire & Iron Goods Co

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Ball Engine Co.
Canadian Austin Machinery
Canadian Equipment Co.
Link-Belt Limited
Erie Steam Shovel Co.
General Products Co.
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McGovern, T. J.
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Canadian Austin Machinery
Fate-Root-Heath Co.
F. H. Hopkins & Co., Ltd.
Jeffrey Manufacturing Co.
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Jenkins Bros. Ltd.

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Meters
Builders Iron Foundry

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Orton & Steinbrenner Co.

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Canada Wire & Irons Goods Co.
Dennis Wire & Iron Works Co.
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Ornamental Moulds
London Concrete Machry. Co.

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Barrett Company, Ltd.
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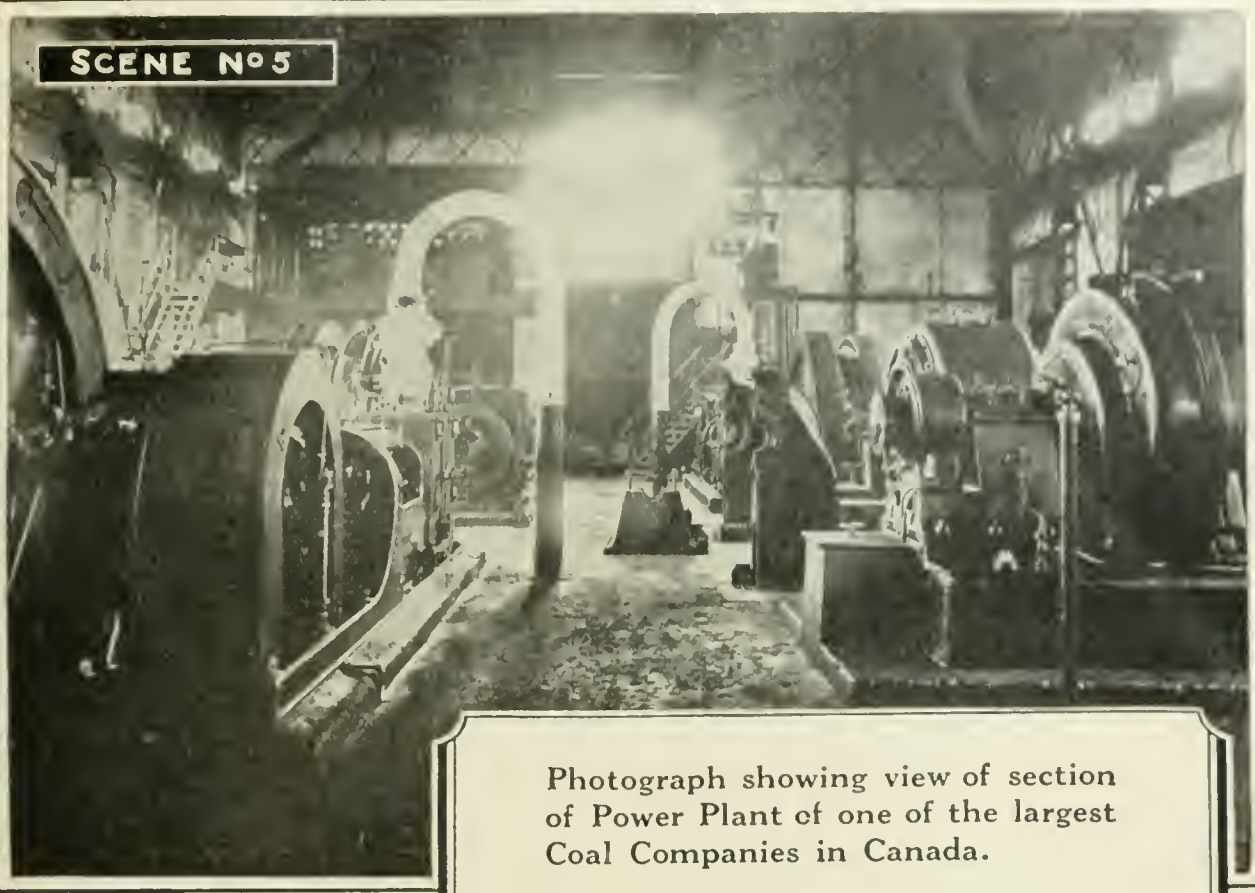

Photograph showing view of section of Power Plant of one of the largest Coal Companies in Canada.

All lubricants in use in this plant are supplied by Imperial Oil Limited.

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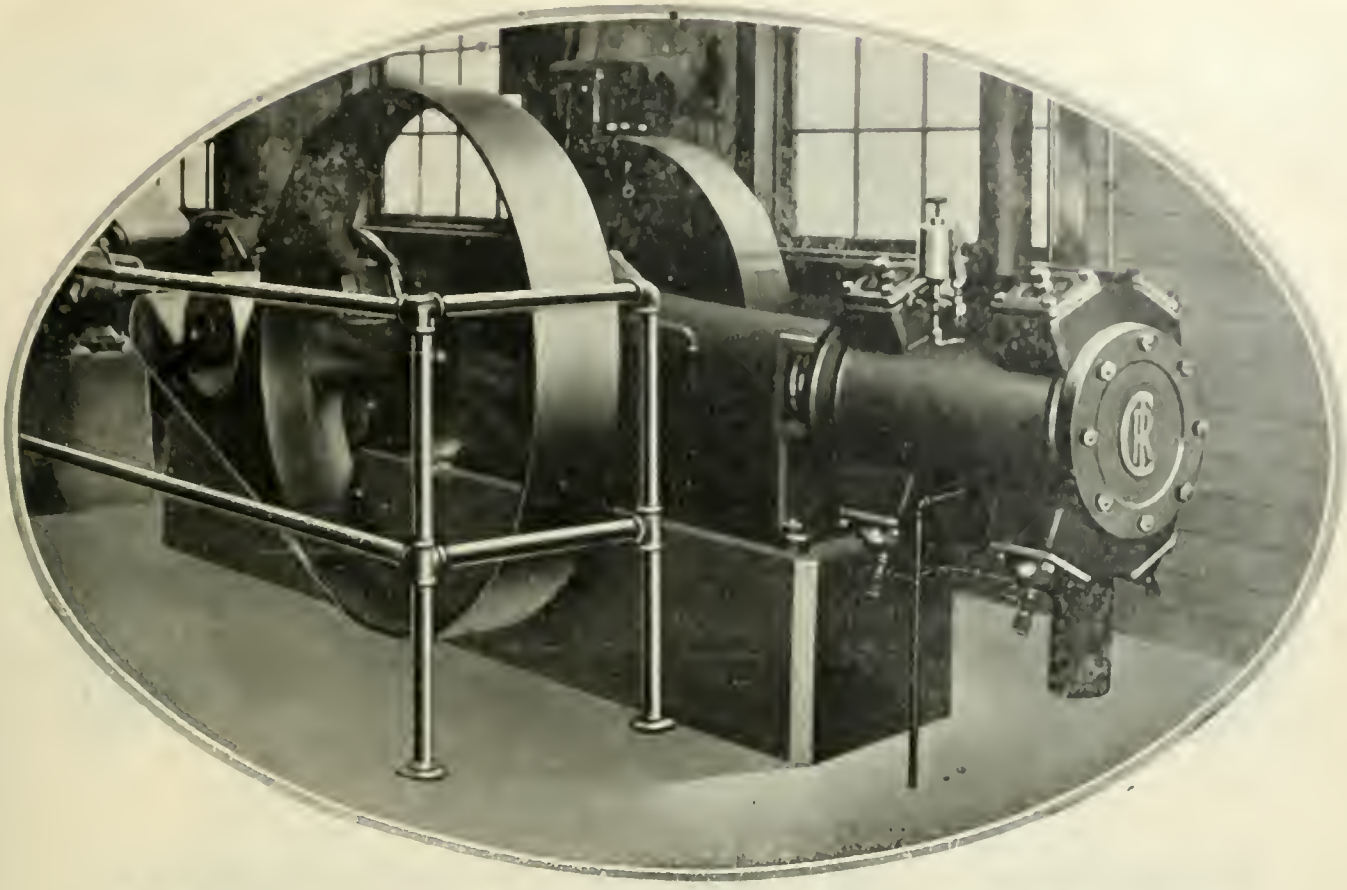

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Class "ER" Belt Driven and Class "FR" Steam Driven Compressors have all these features and many more. Every detail of design and construction has been worked out with one chief idea in mind—a compressor which will actually deliver the greatest number of cubic feet of air per dollar spent for power, upkeep and attendance.

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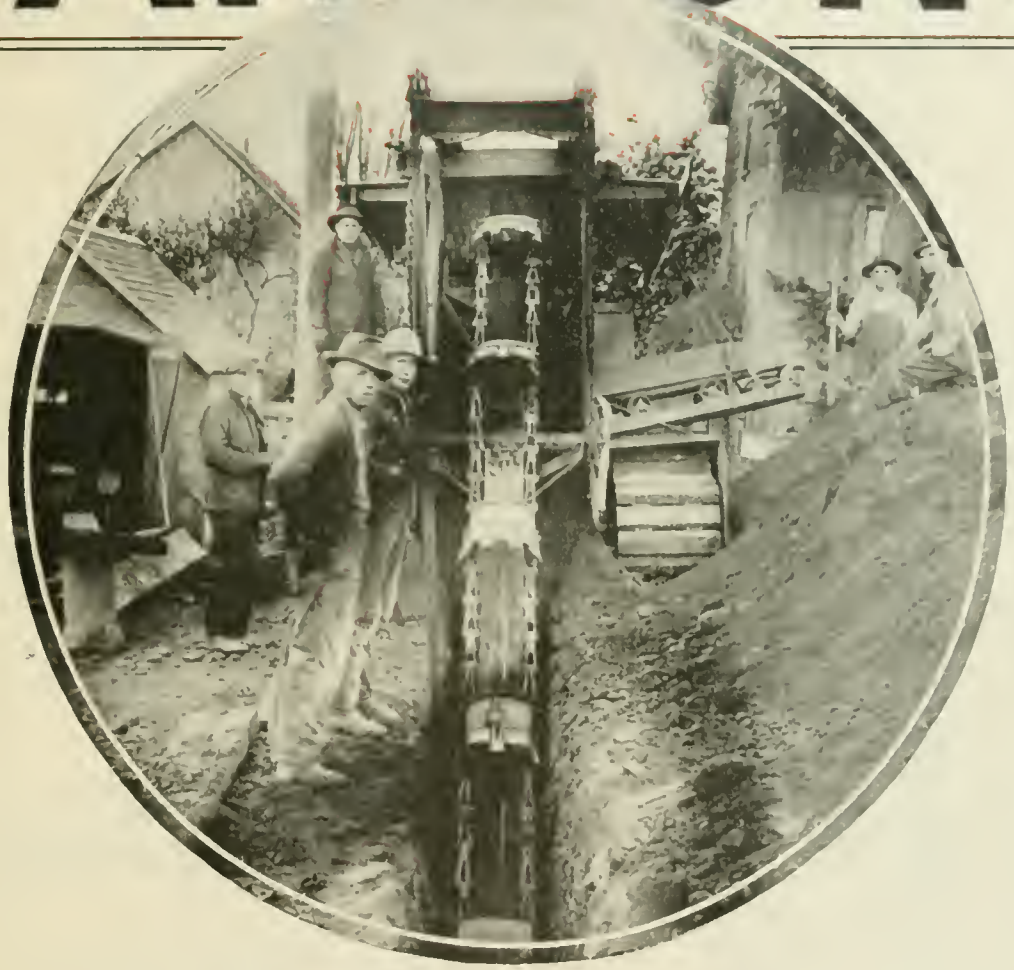

For many years the E. R. Harding Co. Inc., Contractors Public Works of Racine, Wisconsin, have used Parsons trench excavators. At the present time they own one Model 48 and two Model 36 machines concerning which Mr. E. R. Harding writes: "We purchased one of your No. 48 excavators about six months ago for our work at Paducah Ky., laying 30-in. vitrified tile from 17 ft. to 22 ft. deep, and wish to say that the machine has given the best of satisfaction.

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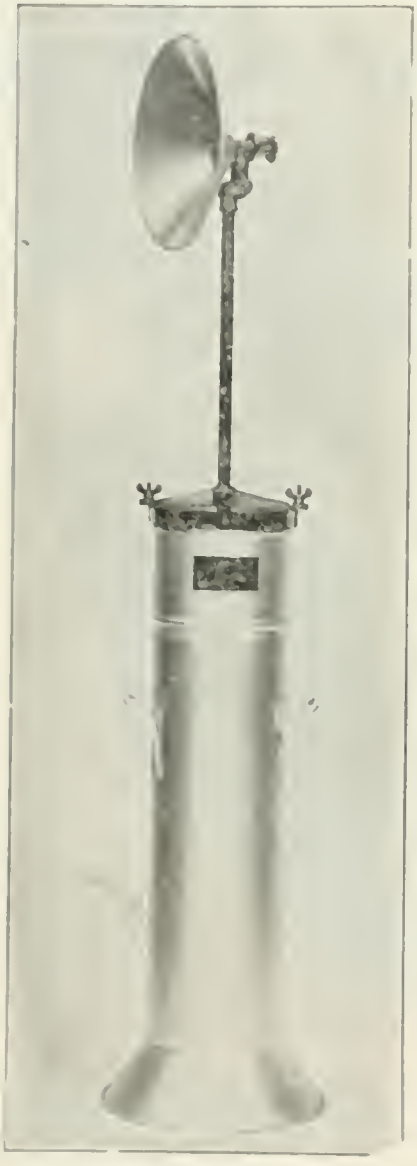

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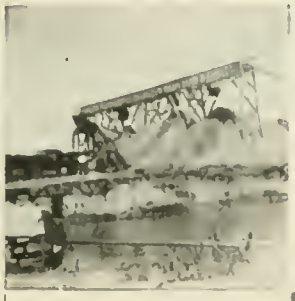
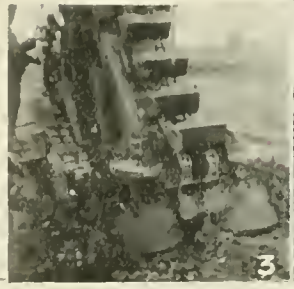


No. 1 shows a Barber-Greene which provides a flexible loading system for the Papkon Margaroff Company of Milwaukee. The Barber-Greene requires only one man and can load a truck with 5 cubic yards in 3 minutes. Further details below.

No. 2 and 3 show a Barber-Greene being used for stripping by the Continental Products Company of Caledonia, New York. No. 4 shows Barber-Greene U-Type Conveyor used for loading gravel by the District of Burnaby, Canada.



Providing a flexible loading system for washed sand and gravel

A washed sand and gravel plant in Wisconsin had a difficult loading problem to solve. Its sand and gravel are pumped from the adjacent pit and are finally discharged into storage piles. Each size, of course, is stored in a different pile.

Very often the sand in these piles, except that at the edges, is too wet to be sold. In order to load all the salable sand as soon and as fast as possible, an extraordinary flexible method of loading had to be found.

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It proved that it could load a maximum of 250 cubic yards of washed sand and gravel per day.

It proved that it could load a truck with 5 cubic yards in 3 minutes.

It is operated by one man. No help is needed; the automatic disc feed cleans up as it feeds.

In every way Barber-Greenes provide the flexible fast, economical system of loading that the conditions require. They move around under their own power to a pile where there is sand or gravel of the right size that is dry enough to be sold. They load as many trucks there as there is material available and then move on to another part of the pile, or to another pile, and load there.

There are, of course, many other methods of using Barber-Greenes in sand and gravel plants.

For additional information send for our sand and rock handling literature.

Also note photograph No. 4 showing the Barber-Greene U-Type Conveyor.

The base price on this conveyor has recently been reduced to $350.

Send for prices covering electric or gas engine equipment.

Ask our nearest office for particulars

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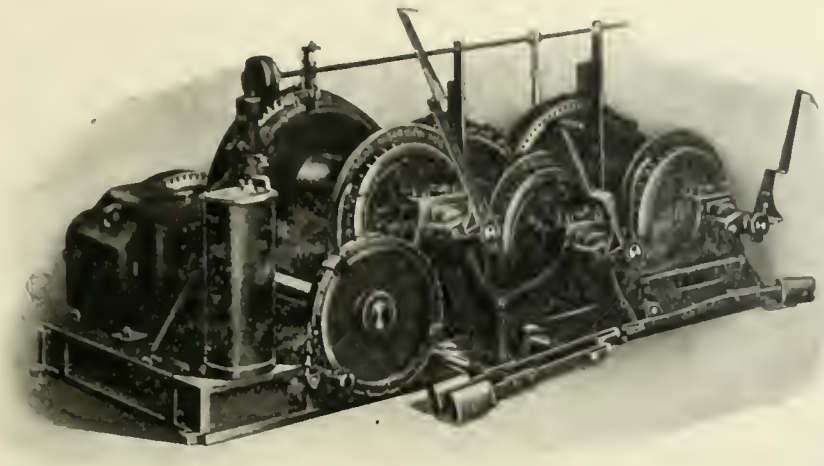

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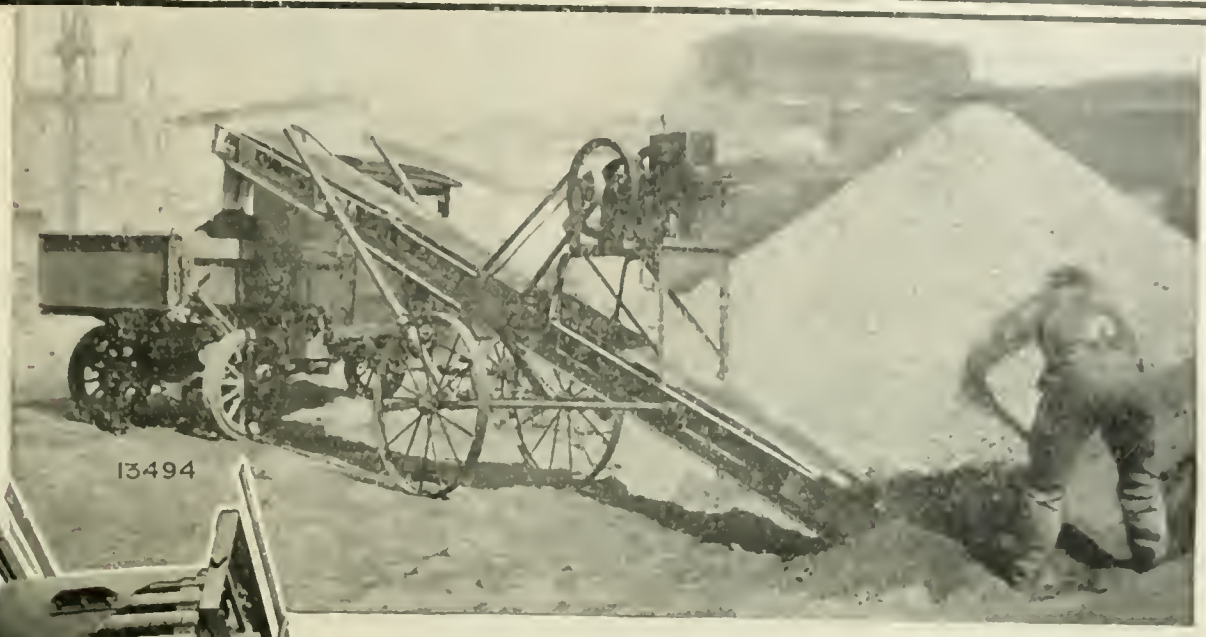

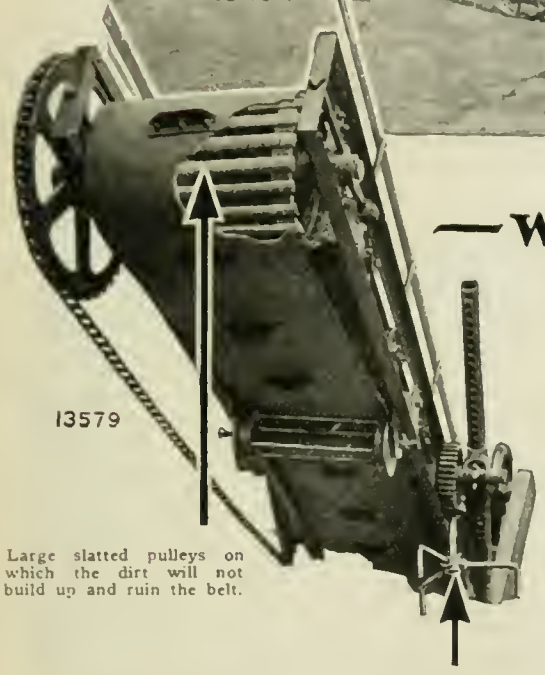

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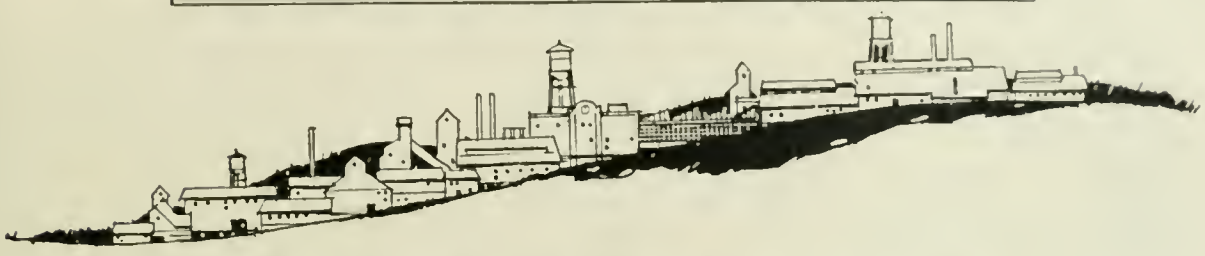

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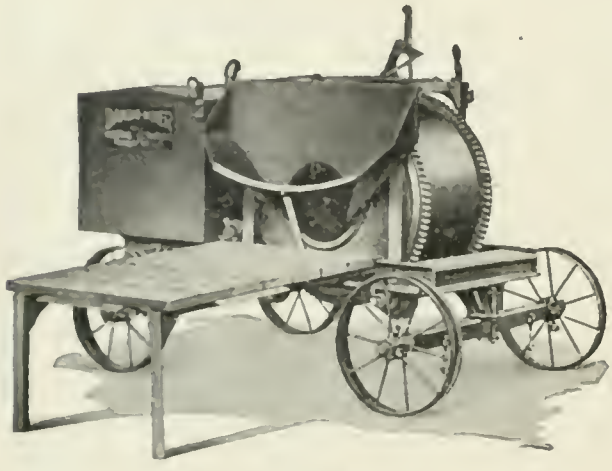

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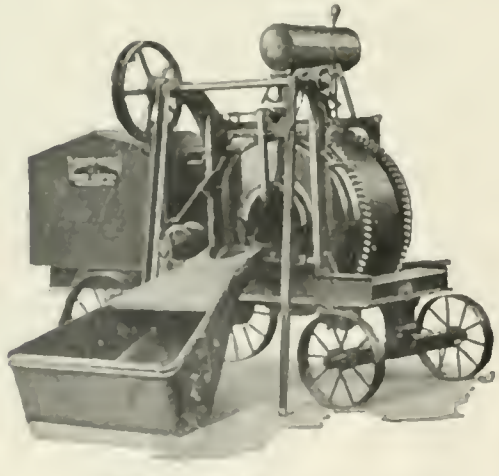

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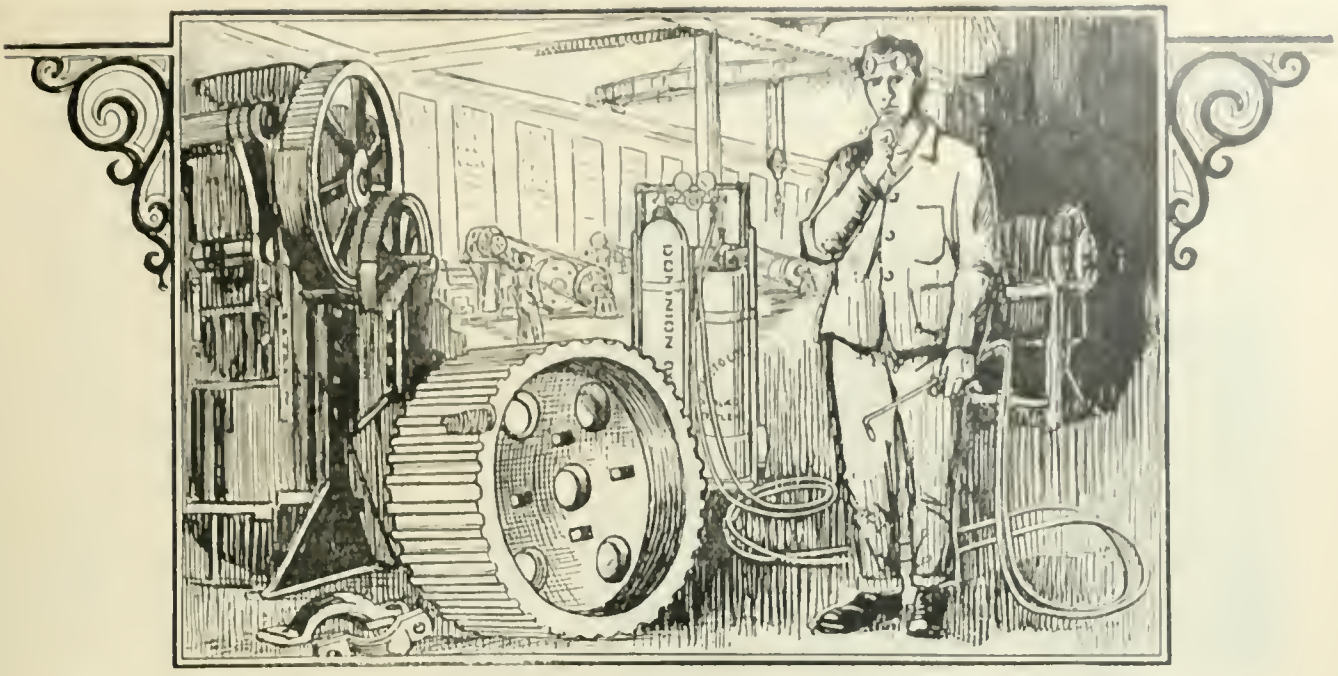

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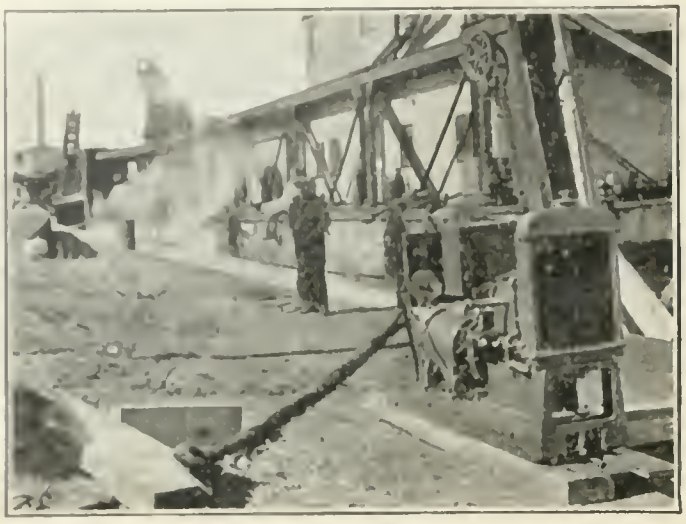

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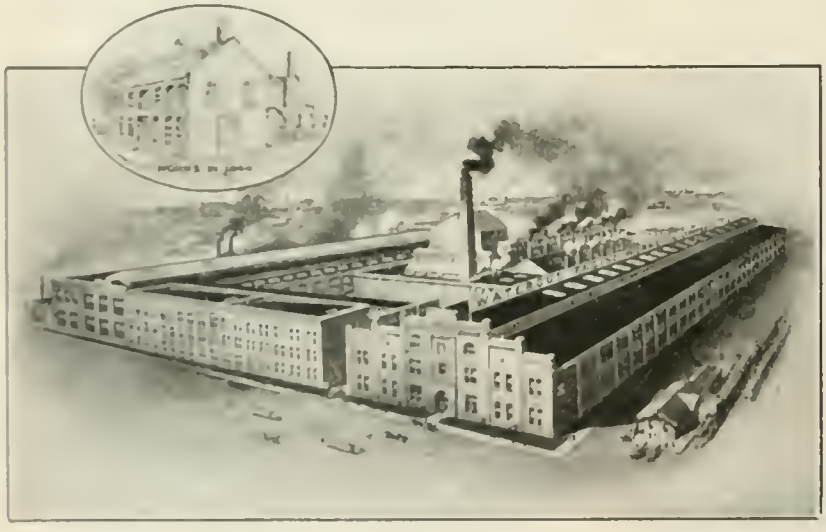

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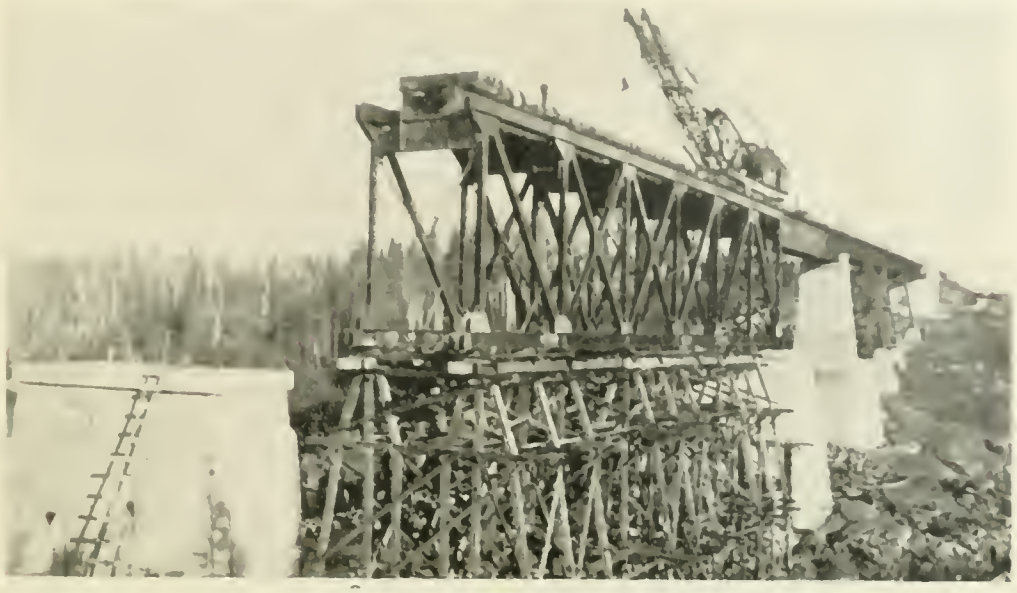


Bridge over Abitibi River, under construction

Interesting Railroad Construction in Ontario's North Country

70-Mile Extension of the Temiskaming and Northern Ontario Railway Northward From Cochrane Required Out-of-the-Ordinary Procedure—Large Bridges Over River Crossings

At the regular weekly meeting of the Toronto Branch of the Engineering Institute of Canada, on November 29, Mr. S. B. Clement, chief engineer of the Temiskaming & Northern Ontario Railway, read a most comprehensive and interesting paper dealing with the North Country and particularly with the T. & N. O's part in its development. Mr. Clement first sketched, in a historical way, the opening up of Northern Ontario and the development of the resources for which that country is noted. He then stressed the factors which led up to the establishment of the T. & N. O. Railway and those which have compelled an extension of the line into a hitherto unopened territory. The last half of this paper was devoted to a review of the various resources of Northern Ontario, which will be tapped by the T. & N. O. Railway and its proposed extensions. The significance of the pre-Cambrian area, in which category Northern Ontario falls, was explained by Mr. Clement, who saw in the more thorough investigation of that area, the possibility of almost unlimited and certainly unanticipated wealth and mineral value.

From Mr. Clement's paper are abstracted below portions which relate particularly to the construction features of the 70-mile T. & N. O. Railway extension from Cochrane northwards.

In selecting a route for the extension of the Temiskaming and Northern Ontario Railway for the purpose of developing the area between the Transcontinental Railway at Cochrane and James Bay, an endeavour was made to locate it through or convenient to areas that appeared to have the best prospects of an early industrial development. It was found that the most desirable route would be obtained by following the Abitibi River. This route would be through the better drained areas most suitable for settlement, it would cross a number of large rivers at points where pulpwood and timber could be collected for manufacture or shipment and would be close to a number of large water powers, the development of which would lead to the establishment of pulp and paper mills or other industries. It was also considered that any extension should be capable of being ultimately extended to a terminus on James Bay. The most suitable harbor on the bay was found to be in the estuary of the Moose with a site for a railway terminal on the west bank near Revillon's Post.

Comparatively light gradients, one half of one per cent, have been obtained with maximum curvature of four degrees. The grading is quite light except in the vicinity of Abitibi Canon, about 75 miles from Cochrane, where there will be four or five miles of heavy excavation, mostly in sand. The numerous river crossings will require comparatively heavy bridging.

Difficulties of Construction

The usual difficulties accompanying railway loca-

heavier filling through the muck to a firm bearing, the displaced material rising on either side. In a few instances during ballasting operations there were settlements of muskeg embankments. It does not appear to be practicable to anticipate these settlements. Although the muskegs are deeper and softer where the timber is sparse and stunted and wide crosslogging may be used under the embankments where considered necessary, generally this type of sink hole develops where least expected.

Landslides along the banks of many of the rivers in the clay belt, have been of frequent occurrence. A recent slide on the Blanche River in the fifth and sixth Concession of Evanturel, is of sufficient interest to be briefly described. This slide affected the west bank of the river for almost one half a mile and extended back, in places, for several hundred feet, and covered an area of about 50 acres. The original bed of the river was blocked and the water dammed back until it flowed over the narrow flood plain on the east side. At the lower end of the slide ,the bed of the river rose vertically about forty feet, while at the upper end, the original river channel was filled by the movement of the west bank. The slide appears to have been due primarily to the flowing of an underlying stratum of very soft viscous clay. The overlying stratified clays broke along horizontal and vertical planes. The bridge abutment shown was moved about 200 feet horizontally and 40 feet vertically.

Sand or gravel suitable for ballast was not found in quantity along the line of the railway. Some difficulty even was encountered in finding material suitable for trestle filling. Except for a small quantity of selected material, obtained from the trainfill pits, the bulk of the ballast had to be hauled from a pit three miles south of Cochrane. The scarcity of gravel will also make it necessary to haul ballast long distances in the event of the further extension of the railway to James Bay.

By reason of the scarcity of material suitable for aggregate for concrete, only a very few structures could be built in advance of tracklaying, and, except at the two large bridges over the Abitibi River at Mileage 11.4 and 44.4, track was carried over the streams on temporary structures.

The proportions of the concrete used were:

	Cement	Fine aggregate	Coarse aggregate
For reinforced concrete or concrete deposited under water	1	2	4
Mass concrete in forms	1	2½	5
Foundation concrete	1	3	6

The aggregate largely came from a gravel pit about one half mile from the track and five miles north of Cochrane. Fine aggregate predominated in the pit gravel and, to obtain proper proportions, a sufficient amount of screened, coarse aggregate was added.

Bridges and Culverts

Reinforced concrete or corrugated iron pipes up to three feet in diameter were used for the smaller waterways, and as far as practicable were teamed in the winter and placed in advance of the grading. The reinforced concrete pipes are preferable but corrugated iron are lighter and permit of easy handling and were used where the train haul was greatest.

Reinforced concrete top culverts were used where a greater opening was required than could be provided

by a double 30 in. pipe culvert. Theoretically arch culverts are more economical in material, but a slight settlement of either bench wall results in serious cracks, if not in the complete failure of the arch. It is difficult to avoid settlement when on the softer clays, even when piling is used and to repair or rebuild a broken culvert under a high embankment and maintain traffic, is a costly proceeding. Scrap rail reinforcing is used throughout in this type of culvert. It accumulates in large quantities on railways and costs per pound but a fraction of the cost per pound of reinforcing bars. In many cases sufficient rail is used in the tops to carry the load and the concrete merely serves as a protection.

In crossing the larger streams, the use of high bridge abutments was avoided where possible, particularly on unsuitable material or on steeply sloping banks. A steel trestle was a type that was largely used. The length of the centre span is, of course, fixed by the width of the stream but for the approaches 35 ft. towers and 55 ft. spans are standard.

Where foundations are good as on solid or loose rock, and within certain limitations as to height, a reinforced concrete abutment with concrete slabs has been successfully used and is more economical than a U-type abutment. All bridges were designed for E-60 loading and in accordance with Canadian Engineering Standards Specifications with B. C. fir decks.

The bridge at the first crossing of the Abitibi River, Mile 11.3 consists of one 75 ft., two 110 ft. and three 90 ft. deck plate girder spans, supported on concrete piers and abutments. The footings in all cases were on hard pan. In the design of the bridge, provision was made for the raising of the level of the river that would follow the development of the Long Sault Rapids water power. A pool elevation at approximately the level of the tail race at the Iroquois Falls plant of the Abitibi Power and Paper Co. was assumed, and in anticipation of navigation of this pool, a clearance of 14 ft. was provided. Apart from this restriction longer deck truss spans in place of the 110 ft. plate girders could have been used.

Satisfactory concrete gravel was found on each side of the river within teaming distance. Simple concrete mixing plants were installed on the top of each bank. The south abutment and piers *No. 1* and *No. 2* were poured from the south bank and the other piers from the north bank. Although [illegible] advance of the tracklaying.

In this structure there are [illegible] and 3142 cubic yards of concrete.

An unexpected summer flood of unprecedented volume swept away the cofferdam on pier No. 2. The work on the other piers was well advanced and to avoid several months delay to tracklaying, temporary construction was used in place of the two 110 ft. deck plate girders between piers No. 1 and No. 3. Two 55 ft. deck plate girder spans already fabricated for one of the steel viaducts and a short length of timber trestle at each end were used to span the opening. Timber bents built on the cribs of the cofferdam supported the abutting ends of the girders, thus avoiding the placing of piling in the deep and swift channel. On the completion of the pier, the temporary work was removed and the 110 foot spans placed in permanent position. The timber in the temporary structure was used again elsewhere for false work.

Second Abitibi Crossing

The other crossing of the Abitibi River is at Mile 44.4, midway between the Carrying Places and Island Portage. On the completion of the Hollinger Power development at Island Portage which is one and one half miles below the bridge site, the level of the water will be raised to the foot of the Long Sault Rapids.

The bridge over the second crossing of the Abitibi River on the T. & N. O. Ry. Construction being carried out by the Hamilton Bridge Works Co., Ltd.

A 220 ft. deck truss spans the present river channel and clears the regulated water level by 7½ ft. Deck plate girder approach spans provide additional clearance for navigation. The total length of the bridge, 670 ft., comprising five 55 ft., two 35 ft., and one 100 ft. deck plate girder spans and one 220 ft. deck truss span.

The steelwork is carried on concrete piers and pedestals, all of which are on solid rock except the south abutment and adjacent pedestals, which are on hardpan. All concrete was mixed in a plant at the top of the south bank and was spouted to and then elevated at piers "C" and "A." Concrete for the north end was spouted to cars and trammed across a suspension bridge and then elevated and spouted to the forms. This suspension bridge was so adjusted that both loaded and empty cars crossed by gravity, except for the last few feet at each end where they required a little assistance.

The erection of the truss span involved the placing of false work under considerable difficulty. The cur-

against the current by a long wire anchored to a projecting rock, a short distance above the bridge. On these piles timber towers were built under the alternate panels. In this structure there are 1,015,123 lbs of steel and 3,685.8 cu. yds. of concrete.

How Should Contractors' Equipment Rental Charges be Computed?

Fundamentally, the Problem is One as to the Cost of Owning the Equipment—A Rational Method Outlined in an Analysis Prepared for the A. G. C. Committee on Methods

By STANLEY STOKES

A rental charge should include the total cost of owning a machine plus a reasonable profit on the contract transacted. The question as to how a rental charge should be built up is fundamentally a question as to the cost of owning the equipment. Having obtained this cost, we then add a profit on the rental transaction and have the total amount which should be obtained as rental. There then remains only the problem of the best and most practical way of distributing this charge. Therefore the problem can first be examined with respect to the cost of ownership.

The several items constituting the cost of ownership are as follows: Interest on original investment, taxes and insurance, depreciation, maintenance, general expense and profit.

Let us now examine each of these items more in detail.

The Cost of Borrowing Money

Under the heading of interest we must include the total cost of obtaining money. This cost varies considerably, depending upon the nature of the loan, whether a short-time bank loan, a real estate mortgage, a bond issue or various other possibilities. The nominal rate of interest is not sufficient to cover all expenses. For example, on a bank loan, the interest is usually figured as a discount. Thus if you pay 6 per cent. for $100.00, the $6.00 is deducted in advance and you obtain $94.00. This is at the rate of 6.38 per cent. If you make a real estate loan, you usually have a commission of 3 per cent. on a 3-year loan, or at the rate of 1 per cent. per year plus title examination and recording fees, which with a nominal rate of 6 per cent. makes your money cost about 7¼ per cent. If you borrow money in the form of a bond issue, you have some legal expense, brokerage charges, printing expense and other items which add from 2 to 3 per cent. to the nominal rate. Thus a 5 per cent. bond issue may cost you 1 per cent. to make the issue, with brokers' fees of 2 per cent. and an additional 2 per cent. for printing and other items, leaving you a net amount of $93.00 out of each $100.00 bond issued. You pay 5 per cent. on the $100.00 or $5.00 per year, but since you receive the use of $93.00 instead, your interest rate is 5.2 per cent. This would represent an extremely high grade security.

Considering all these items, a fair interest in normal times for borrowed money would probably be not less than 7 per cent. It should be noted here that it makes no difference whether you borrow the money in small amount for a particular construction machine or whether you have a certain amount of borrowed money in total for the business sufficient to furnish working capital and buy machinery as needed. The latter is more properly the way to regard it, so that the proper interest rate for a construction machine would be the same as the average cost of money for the business.

Taxes and Insurance

Taxes as such are only too familiar today, no further discussion being required. In a city, the usual personal property tax rate is about $2.50 on each $100.00 of the assessed valuation. The average assessment for the life of the equipment probably would not exceed 40 per cent. of its original cost. Automobile trucks and similar equipment may be assessed higher, but would be offset by the lower rates on other equipment. However, a frequent error is to assume that personal property taxes are all that should be considered. For example, other taxes are auto license, chauffeur's license, contractor's license, engineer's license, capital stock taxes and, above all, income taxes. Due to the fact that the contractor turns over his investment frequently, the income tax when expressed as a percentage of invested capital must necessarily be numerically large. An investment of your own particular taxes expressed as a percentage of your invested capital may surprise you, if you never carried out the computation.

The amount of insurance carried by the contractor on his equipment will vary with the nature of his business and the character of machinery in use. This item will include fire insurance, boiler insurance, collision and public liability on auto trucks, etc. A study of your own premiums will show you how much you should include for the various classes of equipment owned and rented. Workmen's compensation or employees' liability insurance is not to be included, but considered an overhead expense on the pay roll.

Continuity of Investment

A fundamental concept which must be grasped in order to properly analyze the problem of depreciation is that of continuity of the original investment. This means that the total original investment must be considered to be outstanding continuously. If you want to be able to use a steam shovel, someone must be standing that investment, whether you own it, whether you rent it, or whether you buy it. If such a shovel in your organization or others is to be available, then someone has an investment in that shovel to the amount of its original cost. To some who feel differently about this problem and would like to

consider the original investment as constantly decreasing throughout the life of the equipment, we ask that they be patient with us until we have completed this discussion.

Depreciation in its broadest sense includes all losses in worth arising from physical or functional deterioration which cannot be overcome by current maintenance. Depreciation arises from the following causes: Wear and tear, obsolescence due to new inventions and advance in the art, inadequacy, and catastrophes not insurable, i. e., extraordinary contingencies, floods, etc.

A depreciation reserve is necessary to maintain the original investment intact. In other words, the depreciation reserve plus salvage value of the property should always equal the original cost. In this connection, it becomes necessary to explain what is meant by salvage value. This value is either (a) scrap value, or (b) resale value at the end of a predetermined period. For example, the salvage of a heavy engine such as the Corliss engine is usually taken as the scrap value of its component parts. It is presumed that the engine will run until either worn out or other circumstances force it to be replaced. It usually has no resale value and the most that can be realized is its scrap value. On the other hand, an automobile truck is used for a few years and sold before it is completely worn out. The second-hand market value of such a truck is fairly well determined depending on its age. It makes no difference which type of salvage value is used, the difference between this value and the original cost being the total amount of depreciation. In computing allowances for depreciation reserve, the "depreciation base" to be used is the "wearing value." That is, original cost less salvage value.

Distribution of Depreciation

The question of the preservation of invested capital being temporarily conceded, the problem becomes that of the distribution of depreciation as part of the cost of the output of service. It is frequently suggested that certain physical property which is in perfect operating condition is just as valuable as though it were new, inasmuch as it performs the function for which it was acquired. It is obvious, however, that at some time it will cease to perform this function and that during this interval it will change from a valuable machine to one of no value. The only logical way to regard this change is that it took place at a uniform rate. This concept has to be modified in connection with renting equipment, but is considered as a part of the subject of depreciation. Modification will be discussed later.

As a practical application, let us assume the following examples:

Original cost of the machine	$1,000
Salvage value at end of 5 years	$250
Wearing value to be depreciated	$750
Average depreciation per year	$150
Per cent per year of the original cost for depreciation only	15%

At this point it should be mentioned that there are various methods of setting up depreciation reserves which are known as straight-line methods, sinking fund methods, and others. These will be referred to again.

Maintenance expense includes all repairs or replacements of part of the unit so that it may continue to operate at as nearly its original efficiency as possible. The amount of maintenance depends on the type of the machine and has to be estimated from records of similar machines over a period of years. In addition to ordinary repairs, after each extended period of service, a general overhaul is usually required. This is a proper charge to maintenance. For example, if a machine be rented, even though the renter agrees to maintain the machine in working order at his own expense, still the owner should give it an overhauling when he gets it back, knowing that the only maintenance that the renter will give it is that necessary to keep it in operation.

General Expense

General expense which includes expense of general office, general supervision not properly chargeable to individual jobs, office rent, stationary, printing, postage, and other such items, which are computed from experience as a percentage of the preceding total, in figuring a construction estimate, are likewise applicable to construction equipment. These expenses can be readily determined for a particular business. Such expenses may fluctuate widely as between contractors, due usually to a different method of bookkeeping rather than to any economy which one may obtain over the other. That is, one individual may attempt to charge specific work with a greater percentage of the overhead expense than another. For the purpose of this discussion, without attempting to specify a correct amount, we shall use 10 per cent. of the total preceding expenses as a fair overhead expense.

Profit on money invested in construction machinery should be computed at that rate which would be considered reasonable for the business as a whole. This profit, together with interest paid for the use of money, is usually combined and referred to as "return on investment." The determining factor which fixes a fair rate of return is the risk of the business. Whereas 4 per cent. may be sufficient return on Government bonds, 30 per cent. may be low for a speculative enterprise.

Suppose, without in any way attempting to state what is a fair return on money invested in the contracting business, that for an illustration we assume 10 per cent. Restating our original example, then, we have:

Original cost of machine	$1,000
Life	5 yrs.
Salvage	$250
Interest	7%
Taxes and insurance	5%
Depreciation	15%
Maintenance	8%
	35%
General expense (10% preceding total)	3.5%
Cost of ownership	38.5%

The figure of 8 per cent. maintenance was assumed to have been estimated from previous experience on this machine. Thus, in this hypothetical case we find a total cost of ownership of 38.5 per cent. per year of the original cost of the machine. This would not be sufficient for an annual rental, but to that would have to be added a small profit on the rental transaction itself, which we might take as 3 per cent., making a total annual rental of 41.5 per cent.

This cost of ownership goes on continuously whether or not the machine is being used, and it is fair to assume that the depreciation takes place uniformly

as to be able to rent the machine in a competitive market. For example, inasmuch as the renter is likely to stand the cost of repairs while he is using the machine, he would be willing to pay more for a new machine than for an old one, although both machines are in good condition. Also, he might anticipate fewer breakdowns in a few months than in an old one. For this reason it seems desirable that the rental for such a machine be made higher during the earlier years of its life. In this connection, it may be noted that the maintenance in the earlier years would be less and vice versa. Thus a varying rental would result to some extent in the renter paying the same total cost throughout the life of the machine. Referring to our previous illustration in which our depreciation was 15 per cent. per year for 5 years, we might revise this for rental purposes as follows: First year, 25 per cent.; second year, 20 per cent.; third year, 15 per cent.; fourth year, 10 per cent., and fifth year, 5 per cent., for a total of 75 per cent.

This plan would probably appeal to the renter. It would be conservative in that it carries a depreciation reserve much faster than the straight line method. However, the rates for the early years should not be selected too high. In this connection it might be mentioned that a new company having a large investment in construction machinery might be able to make such heavy charges against its revenue without affecting its ability to pay dividends and thereby impair its credit. In other words, the straight line method of setting up the reserve seems desirable from the standpoint of owning the machine and of determining the total amount which must be derived when it is rented. The variable charge can be used merely as a means of establishing a rental charge, this latter method being a practical modification to meet competitive conditions.

Comparison of the Two Plans

Again referring to our example, with an annual rental of 41.5 per cent. on a $1,000 machine or $415, we reconstruct this on a varying basis as follows:

	1st year	2nd year	3rd year	4th year	5th year
Interest	7%	7%	7%	7%	7%
Taxes and insurance	5	5	5	5	5
Depreciation	25	20	15	10	5
Maintenance	5	5	8	10	12
General expense (10%)	4.2	3.7	3.5	3.2	2.9
Preceding total	42	37	35	32	29
Profit (3%)	3	3	3	3	3
	49.2	13.7	41.5	38.2	34.9

For comparison we would collect rental as follows by the two plans:

Year	Uniform Rates	Variable Rate
1	$415	$492
2	415	437
3	415	415
4	415	382
5	415	349
	$2,070	$2,070

It is apparent that the total annual cost of a machine is approximately a constant regardless of use and therefore increased use results in decreased cost per working hour. Thus, reduced rates could be calculated for any off-peak use which would serve to increase the normal use.

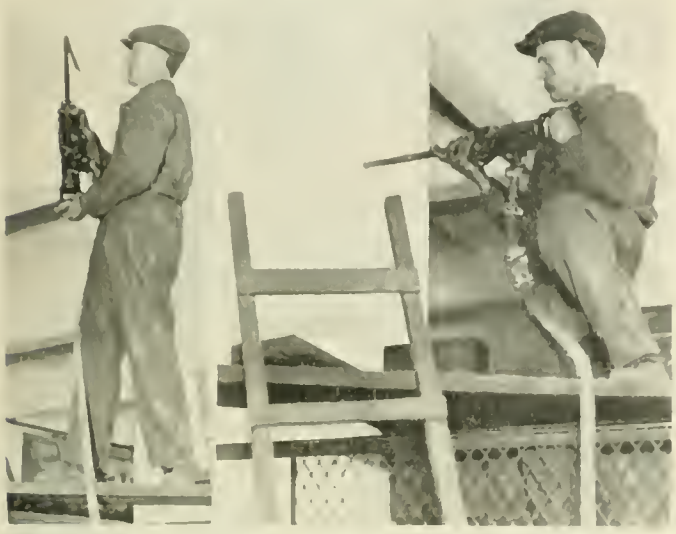
Rock Drills for Structural Work

In Addition to the Regular Applications of Tools of this Class, They Have Many Uses on Building Construction and Save the Contractor's Time and Money

By F. A. McLEAN

On bridge or structural work, in the installation of conduit, piping, motors, generators, machine tools, fire escapes, crane runways, shafting, steel door frames, window sashes, buffer plates, cornices, balconies, etc., it is often necessary to drill holes of various diameters and depths in stone, brick or concrete.

The usual method of drilling these holes with a pipe bit or a hand steel and hammer is by no means satisfactory for several reasons. Cutting speeds seldom exceed one foot per hour and the work is both costly and tiresome. It is almost impossible to strike the steel with a uniform blow and the holes are often larger than actually needed or are of irregular shape and need a lot of patching up with cement or mortar. This makes an unsightly job and sometimes an unsafe one as well.



Left—Drilling expansion bolt holes in concrete ceiling beam with the "Industrial Jackhamer." Right—Drilling holes for conduit

When there are a large number of holes to be drilled or where work is held up, pending the drilling of anchor bolt holes, the cutting or trimming of rock for a foundation or the installation of wiring or pipes, the cost of drilling the holes by hand may be far greater than the cost of the power drilling equipment necessary to do the work.

Holes Drilled in One-Fifth of the Time

Rock drills of various standard types have been successfully used by contractors on the heavier forms of this work for several years. A notable example of their value in this respect, occurred during the rebuilding of the Thomas A. Edison plant at East Orange, N. J. On this job it was found necessary to drill 9,500 holes in the concrete walls to take expansion bolts used for holding the steel window frames in place. Each hole was 3/4 in. in diameter by 3-1/2 in. deep. Through the use of a "Jackhamer" with a special extension steel the work was accomplished in about one fifth of the time that it would have taken by the hand method. Two men handled the drill, one holding the drill itself and the other guiding the bit. They averaged 500 holes a day, their work including the frequent moving of the scaffold and the changing of air connections.

This is a good example of a large number of small anchor bolts drilled economically. An example of a large number of large anchor bolt holes bored at low cost is found in the construction of the Quebec Bridge. On this job there were 170 holes, 4 1/2 in. in diameter and 5 feet deep, to be drilled through hard granite. The work was done by a "Calyx" chilled shot core drill such as is regularly employed for testing pavement and exploring mines. On some occasions drills of this type have been known to cut without trouble through reinforcing rods and heavy steel I-beams embedded in masonry.

One of the earliest known applications of rock drills for breaking masonry was for cutting out concrete and brickwork at the New York end of the Brooklyn bridge to make room for a subway terminal. Hand hammer drills of the one-rotating type were used, as neither the more suitable automatically rotated drills or the modern paving breaker had been developed at that time. The work necessitated cutting through, first, an 18-in. layer of fine cement concrete; next, about 3 ft. of rough gravel concrete, and finally, the brick supporting arches or vaulting. The material was cut away in layers or benches. First, the top layer, which though hard, was fairly uniform and good cutting; next, the rough concrete, which was

Left—Drilling anchor bolt holes in concrete floor with an "Industrial Jackhamer." Very high drilling speeds are made on this class of work. Right—An ordinary pneumatic chipper with a flat chisel is sometimes used for drilling through brick or concrete

[illegible] brick which was [illegible] In one instance it was [illegible] through a steel tie. This was [illegible] with the same drill as was used for the [illegible] in surprisingly short time of 12 min. [illegible] In this confined place every [illegible] of the most congested of traffic arteries [illegible] were called upon to pick out all the [illegible] by hand. For this work a solid hexagon steel with narrow pointed chisel about 3/4 in. across the cutting edge was employed.

A tunnel was constructed in Seattle several years ago to connect the King County courthouse with the [illegible]. This work necessitated the removal of large concrete foundations, for which purpose a jackhammer was employed. The drill was observed to cut at its best a rate as 1 ft. per min.

Large concrete foundations were removed by this method at the Brighton (England) Corporation Electric Works. The concrete was exceptionally hard and many of the broken blocks weighed as much as 20 tons each. An ordinary chisel bit, 20 in. in length, was employed for drilling holes all around the foundations, about 9 in. apart and 18 in. deep. The average speed of drilling was 7 holes per hour, that is, about 10 ft. of hole per hour.

Useful When Installing Equipment

A small rock drill has seen considerable service at a large printing plant. The floor construction is of concrete with brick arches, and the ceiling of tile. The space between the floor and ceiling is used for piping, electric wires, etc., and it is often necessary to cut holes in the floor or ceiling when installing machinery or lights. The drill takes its air from the regular 50 lb. air lines in the building. When cutting concrete flooring, one man can drill a hole through the floor (10 to 10½ in. thick) in 2½ minutes. Ladders or staging are required for ceiling work, and for such work two men handle the drill.

In another case where hanger holes were drilled in rock it formerly required a whole day for two men with hammer and steel to drill 9 or 10 holes, each 4

A [illegible] which converts an ordinary pneumatic chipper into a plug drill for boring holes in concrete floors, etc.

inch in an [illegible] whereas now one man drills the same number of holes in 10 to 15 minutes with a hand [illegible] drill.

Hundreds of cast-iron railway column foundations were removed in New York with the aid of jackhammers. These columns were located above the [illegible] part of the city and have been replaced by concrete foundations. These footings were in the shape of truncated pyramids eight or more feet high and about 4 ft. square on top. After the elevated structure had been supported on [illegible] temporary [illegible] the brick was then broken out with sledge-and-wedge. The same type of drills are often found useful in bridge work for drilling or enlarging anchor bolt holes, trimming off piers, attaching girders to masonry supports at the shore ends, etc.

With the exception of such jobs as cutting large hard rocks for foundations, rock excavation, boring frozen ground or tearing out old concrete or masonry foundations, structural rock drilling requirements can often be met by a somewhat smaller and

Drilling a plug and feather hole with a chipper-plug drill

less powerful drill than the regular jackhamers. With this idea in mind, one company, the Canadian Ingersoll-Rand Company, has developed a very light hammer drill known as the "Industrial Jackhamer."

Light Drill for General Work

The industrial jackhamer is designed for the use of contractors and general work around industrial plants, weighs 21½ pounds, uses ⅞" hollow hexagon steel with bits of up to 1⅝" in diameter, consumes 30 to 35 cubic feet of air per minute at pressure of 60 to 100 pounds and is adapted to all forms of drilling where the rock is not excessively hard and the depth of the holes required not over five feet. Its light weight and small over-all dimensions relieve the operator from unnecessary fatigue and enable him to drill a far larger number of holes in a given time than can be done by the best hand drilled. It is also easily operated in places that could not be reached by hand or with a heavier tool.

In general design the industrial jackhamer resembles the larger jackhamers, the valve mechanism and other parts being similar. All ports are short and direct the inlet being separate and distinct from the exhaust. The rotation is simple, sturdy, automatic and positive. A rifle bar and ratchet are located in the back of the cylinder and impart a rotary motion to the piston which in turn rotates the chuck holding the drill steel, on much the same principle as that made use of in the ordinary automatic screwdriver.

Plug Drilling Attachment

Where there is only an occasional need for drilling a limited number of small holes in stone, concrete or brick a plug drilling attachment will be found useful.

When applied to a chipper a simple plug drill is formed that will drill ¼" to ⅝" holes to a depth of 6 or 8 inches at a rate of speed that far eclipses hand work. When the required number of holes have been drilled, the tool is quickly converted into a chipper again ready to do the work usually done by these tools. In addition it may be used for toothing out bricks, enlarging drilled holes, dressing up concrete and stone, etc.

The plug drilling attachment consists of an alloy steel bolt constructed so that a portion of the air from the exhaust of the tool is deflected and carried through a short hose to a special blowing attachment which clears the cuttings from the hole. A rotating wrench, hose connections and a diamond point or rose bit completes the outfit. The tool is held in one hand and a semi-rotary motion is imparted to the wrench as the drilling proceeds.

It is perhaps needless to point out that while the largest size of bits that are recommended for use with the industrial jackhamer and the chipping plug drill are respectively 1⅝ and ¾ inches, neither tool is limited to production of holes of these diameters or under, since a number of holes can be drilled very close together and the intervening webs then broken

Drilling overhead holes for steel window frames with an air feed stope-hamer. The pneumatic feed cylinder at the bottom of the drill forces the steel upwards relieving the operator of the weight

out by a few sharp blows from a hammer, by chiseling or wedging, or by holding the tool against them and turning on the air allowing the vibration to break them loose. Large holes drilled or cut in this way are generally more regular in shape than those cut by hand. This class of work is usually encountered where it is necessary to cut openings for belts, shafting, windows, etc.

When holes are drilled dry in concrete with hand rotated tools, the natural moisture present seems to cause the cuttings to pack and form a mud collar back of the bit making it necessary to withdraw the steel with a Stillson wrench causing considerable delay. This trouble does not occur with the automatically rotated type of drill [illegible] keeps the hole clean so that the steel [illegible] withdrawn by means of the feed [illegible] integral part of the drills. The [illegible] ted drill is also valuable [illegible] ted or footing trenches, [illegible] swinging scaffolds.

The drills previously mentioned will [illegible] practically all classes of rock drilling around the average structural job. Where a number of [illegible] large overhead holes are required, however, it is sometimes more economical to use the "stopehammer" type of drill employed for overhead drilling in raises and stopes. These drills are equipped with an air operated feed cylinder which forces the drill forward thus relieving the operator from the weight. Drills of this type are used either wet or dry, cut rapidly and are very easily controlled even in very close quarters.

This article does not by any means cover all of the possible applications of rock drills on structural work. The writer hopes, however, that some of the "kinks" will prove useful to those engaged in construction work.

Electric Hoists Prove Profitable for Handling Materials

In Manufacturing Plants, and Even on Construction Jobs, They Pile up Handsome Profits

By RUSSELL B. WILLIAMS
Link Belt Co., Chicago

In the solution of our transportation problems we spent many years striving to eliminate the human element from vertical handling. Though a man might more or less promisingly move an object along the floor, it required doubled and redoubled effort when necessary to reach new levels. So we invented continuous bucket elevators, spiral "Helicoid" conveyors, skip hoists, endless belt conveyors, platform elevators and other devices for the lifting and lowering of objects. And of these inventions few indeed have failed to far more than pay their way.

Now, there yet remained the problem of horizontal transportation. This presented difficulties, for in almost every instance, obstacles to progress were numerous. Machinery, work benches, piping, motors, everything on the floor, presented just that many reasons why the transportation of objects horizontally, by mechanical means, would be difficult

Solution of Horizontal Transportation

So, in the solution of this problem—in the very act of scratching our heads and looking upward—we discovered the ceiling! With practically nothing on it! We had built them on every house, barn and factory, but had failed to consider them good for anything but shelter and the suspension of a light or two. After the discovery of our own ceiling, the rest was comparatively easy.

Thus it was that the modern electric hoist was made possible, a thing of rapid and ready transportation in so many plants and in so many duties. For with the electric hoist, everything mechanical is out of the way, yet instantly available. Your [illegible] transporting objects is identical with that of man power. The electric hoist lifts the objects from the

...their carrier them to the desired place and sets them down.

Electric hoists, and other machines designed for the conservation of labor, have proven an unqualified success. The economies effected through their wide application are on every hand, for they have long since passed the experimental stage and have received quite universal use.

Mr. Buhler, chief engineer for the Philadelphia Paper Manufacturing Company, for instance, employs two electric hoists, one in the removal of ashes from the boiler room, which hoist has been in continuous use for over nine years, and one in the disposition of rubbish, carrying it from the mill to the incinerator.

In considering the savings or economies effected by the rubbish hoist, Mr. Buhler says: "It can safely be said that did we not have the electric hoist and were compelled to dispose of the rubbish by hand, it would be necessary to add two men to our payroll.

Three Link-Belt electric hoists handling structural steel to and from punch presses, welders, cutters, etc.

This extra help, at prevailing prices, would run into a $12 daily labor cost. Saving twelve dollars a day totals $3,600 annually, considering that we operate 300 days in the year. This is the gross saving effected by our electric hoist handling rubbish from the mill to the incinerator.

"Of course, to arrive at the net annual saving, it is necessary to deduct all expenses incident to the maintenance of this hoist. These expenses can be calculated as follows:

Interest on investment at 6 per cent.	$ 72.00
Depreciation on 10 year basis (conservative)	120.00
Repairs (estimated)	160.00
Maintenance—oil and attention	50.00
Total expense, yearly	$402.00

Thus we have an expense of $402.00 for a piece of equipment that is saving us in labor costs alone $3600. The difference, $3198.00, is the net annual saving."

Used for Dirt Disposal

A rather unusual application for an electric hoist is seen at the publishing plant of the "Boston American," where Adams and Pond, general contractors, have been employed in the excavation work that will enlarge the present building and make possible the installation of additional presses in the basement of their present building.

Because this excavating must be carried on without serious interference with the daily operation of the newspaper offices and plant, it is impossible to use a steam shovel or crane. Only a small portion of the floor could be removed, the dirt and refuse being compelled to come out of that "hatch way."

In order that this unusual condition might be met satisfactorily, an electric hoist was pressed into service. This hoist lifts large buckets of dirt and refuse from the floor of the basement to the street level, carrying them over the awaiting truck, where they are dumped, the bucket being returned to the basement for refilling. The capacity of this hoist is 12 to 14 trucks a day, each truck carrying the refuse of from 14 to 16 buckets.

If it were not possible to employ this Link-Belt electric hoist, it would be necessary to remove all the dirt and refuse by hand. And this would necessitate the construction of two shovel platforms, each platform requiring no less than three men with shovels. Not only would this slow down the work (it being impossible for these men to load this number of trucks a day) but the construction of the shovel platforms would make necessary the destruction of the present sidewalk, with subsequent replacement at the time the work was completed.

Thus this hoist saves the labor of six men a day, which at $4.00 a day totals $7,200 a year. This is the gross saving effected. The net saving is figured at $3,636.00, as the expense incident to the operation of

Electric hoist in power plant of Philadelphia Paper Mfg. Co.

this hoist must take into account the wages paid the operators, and are therefore very high. Its operation requires two men, in this instance, one acting as operator at $2,000 a year, the other dumping and caring for the buckets, at $1,200 a year. Kilowatt input, interest, depreciation, attention, etc., total $364 annually. This makes a total maintenance and operation cost of $3,564, leaves the above net saving. This annual economy does not take into consideration the value of the sidewalk, the possibility of moving the hoist to other work upon completion of the pres-

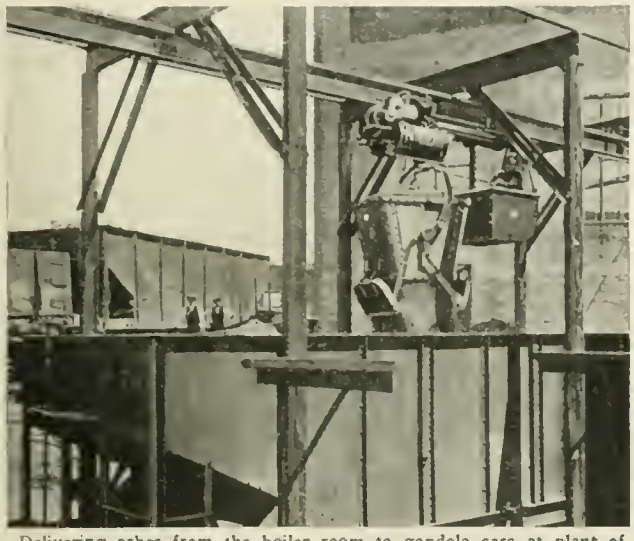
ent job, the increased tonnage taken away, or any of the other factors that would very materially enter into the investment return if closely figured.

Over 50 Per Cent. Saving a Year

Not infrequently there is voiced the belief that unless a piece of equipment can eliminate two or more men, there is little or nothing to be gained through its installation. Evidence to the contrary is to be had at the receiving station of the N. Ward and company, in South Boston, Mass. Here an electric hoist is used to transport large boxes of animal waste from incoming butchers' wagons, through the building to lighters or barges, which carry it to their island plant for transformation into fertilizer.

As this hoist is now operated, it saves the labor of but one man a day, which equals, in dollars and cents, $1,200 a year. As small as this saving may seem, it represents an investment return of well over fifty per cent. a year.

The electric power that operates this one-ton electric hoist comes through a separate meter, and it is interesting to know that although the hoist is in daily use and is being used an average of five or six hours



Delivering ashes from the boiler room to gondola cars at plant of Philadelphia Paper Mfg. Co., with an electric hoist

every day, the power consumption has not exceeded $4.75 a month since its installation some six years ago. Oil requirements are normal. One quart of oil a week or approximately 12 gallons a year, is used. The repairs (purchased directly for this Link-Belt electric hoist) have been but $14 for the entire period of operation. There were, however, some expenses incident to the trackage, trolley, scales, and so forth. All told, the maintenance cost of this hoist averages $325 a year leaving a net annual saving from the elimination of one man of something like $675. And this return is from an original outlay of about $1000, which included a long, curved, hinged track, trolley, and complete equipment.

In this advanced mechanical age, the ability to move objects is the determining factor in the progress of industrial concerns. To those who can move their materials most rapidly, cheaply and efficiently, is accorded the largest measure of success.

Correction

Our issue of November 28 contained an item to the effect that the Board of Control at Toronto had awarded a contract for $20000 worth of cast iron piping to a British firm. This report was in error. The awarding of the contract to the British firm had approved by the Board of Control, but rejected when submitted to the council.

Air Drills Make Record at Shawinigan Falls

In carrying out their operations at Shawinigan Falls, Que., the Grenville Crushed Rock Company had to deal with rock consisting of soft and hard layers of granite full of slips and with small bodies of white quartz scattered throughout it. The layers of granite vary greatly in hardness, sometimes cutting freely for four or five feet and then running hard from four to six feet. These facts are mentioned in order that the following figures may be duly gauged.

The company has on this job three Leyner-Ingersoll X-70 rock drills, and since the first of these tools was employed the management has kept a record of their performances. The results are extremely suggestive, and show what can be done under unfavorable circumstances. During the month of July past, an exact record of the footage drilled and time consumed was kept for each drill. All the machines were fitted with standard 1-1/4-inch, hollow, round steels, with "Leyner" shanks. The starter bits were of 2-7/8 inch diameter, and 1/8-inch changes on 24-inch runs were used. The depth of holes drilled varied from 12 to 22 feet, while some holes were drilled to a depth of 28 feet. The air pressure employed ranged from 80 to 85 pounds. The thing that must be borne in mind is that the character of the ground made drilling at times extremely difficult because the rock prevented the rotation of the steels; and two of the drills had to contend with material of this sort for considerable periods. Work was carried on in 8-hour shifts.

Date	Drill No. 1	Drill No. 2	Drill No. 3
July 1	83 ft.		
" 2	75		
" 3	62		
" 4	72		
" 5	62		
" 6	76		
" 7	76	54 ft.	
" 8	67	65	
" 9	80	64	
" 10	76	75	12 ft
" 11	64	74	52
" 12	82	76	96
" 13	92	105	103
" 14	78	86	101
" 16	75	74	89
" 17	98	84	110
" 18	87	71	64
" 19	78	66	96
" 20	79	53	103
" 21	74	70	70
" 23	88	75	104
" 24	80	87	111
" 26	45	60	83
" 28	80	65	85
" 29	70	55	
" 30	49	45	52
" 31	60	55	32
	2,008 ft	1,460 ft	1,386 ft

Average per hour, Drill No. 1, 9.5 ft.; drill No. 2, 8.7 ft.; drill No. 3, 10.2 ft. General average of 9.4 ft.

Considering frequent delays caused by bad ground, etc., the foregoing record is remarkable. There were no breakages of any sort; and on six different days drill No. 3 drilled more than 100 feet.

Time Control in Building Operations

The Preparation of a Progress Chart and its Uses in Ensuring Completed Work Within an Agreed Time Limit

By the Morton C. Tuttle Co., Constructors, Boston, Mass.

The industry of this continent is leading the world in most aspects of production, largely because of its ability to master the control of time. This is perhaps in general the ability of American industry to schedule its operations—to plan component parts of large undertakings so that a thousand activities may be coordinated and focused at a predetermined point in a predetermined manner.

The small time manufacturer, working on an output far simpler than today's, with his sources of material often conveniently near, and with a market lacking today's capriciousness of demand, handled his plant very largely by cut-and-dried methods, worked over time with his men when pressure was severe, and, sometimes, let them into the hay field when the season was slack. That implied, of necessity, a small plant, a limited output, and a labor force predominantly of native-born men able and willing to do a number of different things reasonably well and ready to make themselves quite at home in any one of a variety of situations.

But as output became more complicated, as the reach for supplies began to extend well around the globe, as huge but transitory markets began to develop, as specialists came into the field of management and of labor as well, as—perhaps most influential of all—costs began to increase and margins of profit to diminish, it became necessary to concentrate many small plants into one large factory, and, having so done, to lay down careful schedules of operations—to build the product on paper and then to control the time devoted to each process in its manufacture, so that all departments of a plant might at all times, in so far as possible, be carrying a balanced load; and, further, so that unlooked for delay in one quarter might be prevented from throwing sequential processes into disorder, at serious cost to the entire undertaking and to its sponsors. Thus it has come to be a recognized principle of the present industrial era that centralized control operating on a predetermined plan is the root of successful manufacturing enterprise.

Construction Abreast of Manufacturing

But this wonderful development of planned control in response to the necessities bred of changing

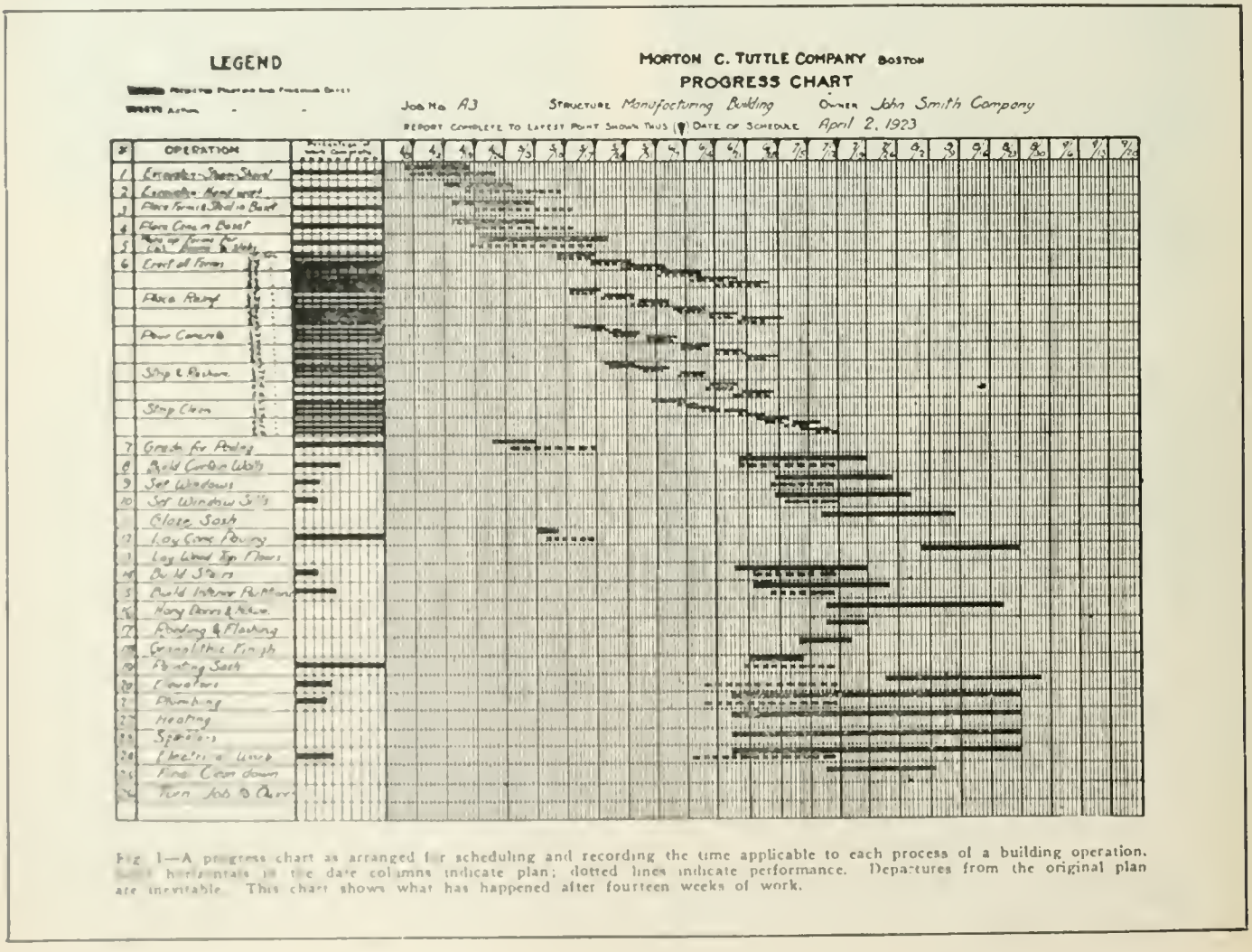


Fig. 1—A progress chart as arranged for scheduling and recording the time applicable to each process of a building operation. Solid horizontals in the date columns indicate plan; dotted lines indicate performance. Departures from the original plan are inevitable. This chart shows what has happened after fourteen weeks of work.

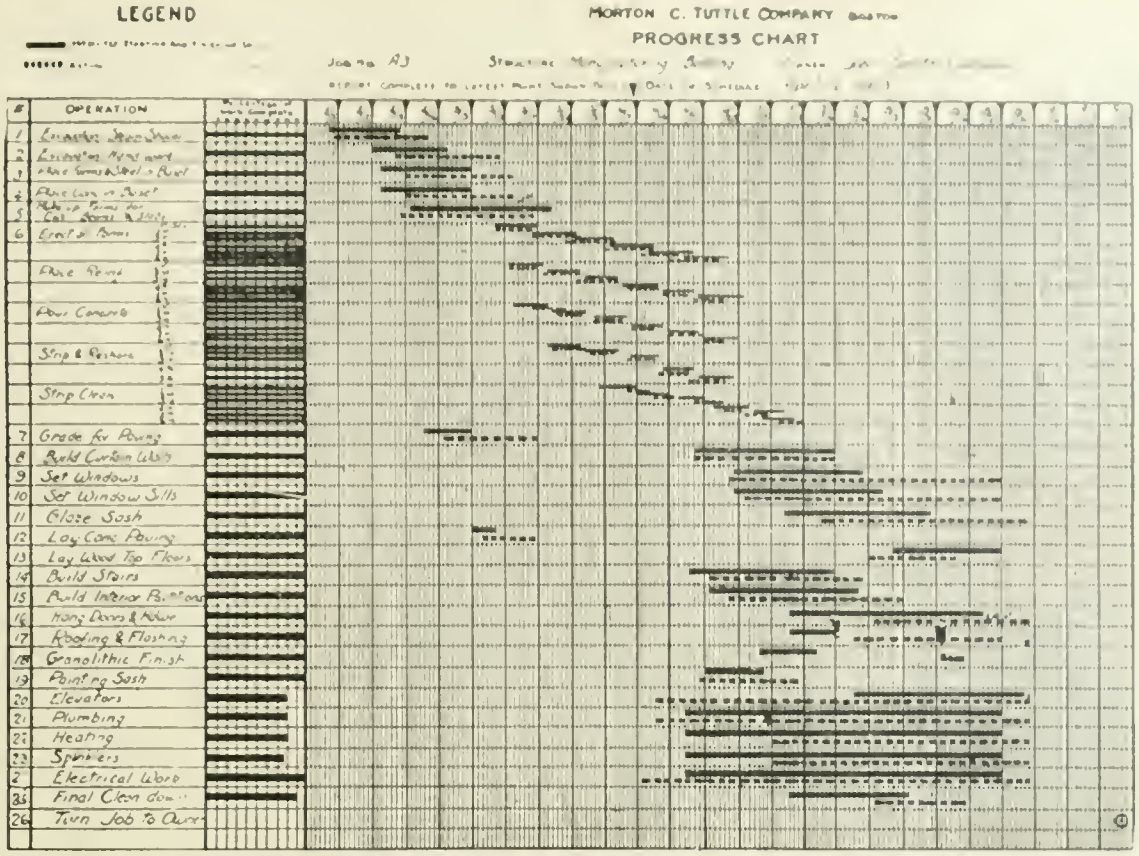


Fig. 2—The preceding chart, as it appears at the end of the twenty-first week of construction. It is inevitable in building that unforeseen delays, together with some alterations in the engineer's designs should occur, with consequent disturbance to schedules. By showing the exact status of each process at a given time the Chart facilitates readjustments and eliminates confusion. Delivery of the building on the promised date is here assured.

economic and social conditions, while true of manufacturing methods, is equally true of methods in the realm of construction. But here the truth is less generally familiar.

There was a time when two men could, without other aid, erect and equip a not inelegant dwelling house. A shop or small factory might prove an even less difficult undertaking. That time is gone. In today's factory we encounter a vast complexity of steel and concrete, curtained with glass, cobwebbed with electric wires, tunnelled with steam conduits, and populated with huge automatic mechanisms whose strength is that of a thousand giants, whose fragility that of a tiny strand of wire. Construction of such a plant calls for powers certainly no less alert and no less highly trained than those demanded for its operation after construction is complete. And, by the same sign, it calls for equally intelligent preliminary planning and equally effective time control.

Some construction companies have realized this and have kept, if anything, rather more than abreast of modern methods of planning, scheduling, and supervising their operations. In some instances, their procedure is such that it is worth recording, not only for the general interest and benefit of others similarly engaged in building, but, as well, for that of industrial managers still on the alert for profitable suggestions from whatever source.

The basic secret of successful construction may be stated almost in a word: it is that of getting the right men and the right materials, in right quantities, at the right place at the right time. And the essence of all this rightness is time. Control of the time devoted to each part of an enterprise means control of the time necessary to its entire completion. Obviously this entails a preliminary plan, which, as actual performance is checked against it, may become a record of progress. And, since such a plan is most readily available when reduced to the graphic form of a chart, it is pretty certain, in due course, to assume both the name and the function of a Progress Chart.

The type of Progress Chart utilized in our company is illustrated in figures 1 and 2.

In this, it will be observed, the entire future operation is analyzed into its main processes, which, listed and numbered in convenient sequence, are posted as the dominant column of the chart. In an adjoining column, space is provided for registering the percentage of completeness of each process on the date of filing the record. As many other columns as there are weeks allotted to the finishing of the entire undertaking are likewise provided. Each of these is identified by a date heading.

Before any work begins, this chart is made ready. The processes are listed, and opposite each one is drawn, in the dated columns, a solid horizontal line which starts under the date scheduled for beginning the process and ends under the date scheduled for its completion. As actual work proceeds, a dotted line

week below the solid one, shows how ... proceeds with expectation.

Recorded Experience: Not Guess Work

... preliminary analysis, with its time allotments, may ... by no means be a purely arbitrary arrangement ... necessity, mid guess work. To be worth ... it must reflect a set of computations based ... recorded experience and modified by judgment of ... particular conditions governing the specific opera... In our case, the time or progress chart is prepared by the general superintendent, in consultation with the various department heads of the company. When completed and delivered to the job superintendent this chart becomes his orders from headquarters. Each week, during the construction period, he is required to fill out a copy to date and forward it to the home office. At the end of any operation, therefore, as many of these progress charts will have been filed as there were weeks consumed in building.*

It is, from the outset, a foregone certainty that the time schedules as posted will not, in all instances, be duly met in operations. The hazards involved in any complex undertaking are far too numerous to admit the hope, much more the expectation, of completely escaping them. Yet to each scheduled process is allotted no more than ideal appropriation of time. Whatever time allowance is reserved for emergencies is shown in the period established between the date of completion called for in the schedule and the date of delivery promised the owner. Separating these two dates, a gap of some days is generally figured.

The illustrative diagrams (figures 1 and 2) show clearly how our progress charts are prepared, how they are filled out, and what conditions of progress or retrogression they may indicate. While, for various reasons, not absolutely literal transcripts from charts actually used, their records may be accepted as thoroughly typical. The first is from the fourteenth week of an operation, the second from the twenty-first week. In offering evidence of human mutability, as well as of inanimate depravity, they equally offer evidence of human power to gain the upper hand of unfavorable circumstance.

Very little further discussion of their details seems called for. It will be observed in figure 1 that, at the close of the fourteenth week of work, nine out of the twenty-five processes constituting the building operation have been fully completed; eight more are under way; and eight are still unattacked, though for some days past scheduled on the chart.

Any one who has tried to hasten the movements of a recalcitrant steam shovel will readily understand what went wrong with the first process. A steam shovel is a monster which may be neither cajoled nor lightly replaced. If its unexpectedly developed troubles are curable, they are best remedied patiently on the spot. This may delay some subsequent items. The chart will enable accurate appraisal of the extent of this delay and of the rearrangments necessary to prevent the coming of labor crews before a place is ready for them.

With the fifth item the work seems to have found its stride. The important fundamentals of number 6 are, likewise, satisfactory, showing, as they do, an almost military precision of accomplishment.

With number 7, however, the march of perfection halts. The scheduled process is a short time one. April weather has behaved true to form. There is not enough at stake to justify expensively heroic methods of wooing a reluctant spring. Delay is here accepted, just as it is in the case of number 12 and of number 17, which last is allowed to wait, pending the natural thawing of an accumulation of ice on the concrete roof-slab.

But there is real trouble brewing behind the curtain walls of number 8. Its time allowance is four-fifths consumed; the work is not half completed. Setting windows is in similar case. A freight breakdown, meanwhile, has stranded the window glass at some point of uncertain location. The owners likewise have made several shifts in the designs for their building.

Here are sufficient complications to occupy the time and attention of a number of experienced men. If the change of building design were extensive, it would entail the preparation of a new chart. But it is only sufficient to disturb existing schedules without disrupting them. Readjustment appears mainly in the equipment schedules, where elevators (20), plumbing (21), and electrical work are speeded up to compensate, if possible, for delay with the heating (22) and the sprinklers (23). But, though begun ahead of schedule, these processes give promise of holding on for the full count of time.

Such is the state of affairs at the end of the fourteenth week. What it is at the end of the twenty-first week appears in the succeeding diagram. In spite of some unfavorable indications on the chart of seven weeks earlier, the total operation is now very little behind schedule. The owners, however, are completely protected. The bull's eye at the extreme right of the chart—opposite item number 26—indicates what is the agreed date for turning over the building to them. That date is still two weeks distant. During those two weeks various odds and ends of work connected mainly with the installation of permanent equipment will be finished and out of the way.

What the Chart Accomplishes

In spite, therefore, of outward delays and inward shifts of arrangement, the chart, originally prepared with some allowances for the capabilities of the unexpected, has served excellently its purpose. This purpose was to direct procedure, to record time already consumed, and to indicate the probable finishing date of each process. Accomplishing these enabled management to strengthen points of weakness as they developed, to concentrate effort on pivotal processes when occasion demanded, and, by keeping at all times clearly in vision the relation of each part to the whole undertaking, so to control the progress of events as to accomplish a satisfactory outcome within the time limit set.

But it is, or should be, clear that a progress chart will not produce its results automatically or unaided. It is less spectacular in its warnings than is a labor-cost chart (Contract Record of Oct. 10, page 962). Perhaps for that very reason it demands closer and more vigilant scrutiny by management, and calls for a finer exercise of judgment in determining precisely what action should be taken when unfavorable indications are encountered. The fundamental requirement that the chart schedules be carefully and intelligently prepared has already been stressed.

* ... of experience with ... subsequent ... seldom twice alike, ... judgment in first preparing a time ... of the causes which ... [illegible]

Contract Record and Engineering Review

A National Journal for the Construction Interests of Canada, reaching Architects, Engineers, Contractors, Municipal Officials, etc.

Member Business Newspaper Association of Canada
Member Audit Bureau of Circulations

Published Each Wednesday by

Hugh C. MacLean Publications Limited

THOMAS S. YOUNG, Managing Director

HEAD OFFICE - 347 Adelaide Street West, TORONTO

Telephone Adelaide 2701

Proprietors and Publishers also of Canada Lumberman, Electrical News, Canadian Woodworker, Furniture World and Footwear in Canada.

MONTREAL		119 Board of Trade Bldg.
WINNIPEG		302 Travellers' Bldg.
VANCOUVER		Winch Building
NEW YORK		296 Broadway
CHICAGO		14 West Washington St.

SUBSCRIPTION RATES

Canada, Great Britain and British Possessions $3.00. U. S. $4.00. Other Foreign Countries $5.00. Single copies 15 cents.

Authorized by the Postmaster General for Canada, for transmission as second class matter.

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Breaking Faith with Civic Tenderers

The Toronto city council recently solicited tenders for the supply of a quantity of water pipe. When the tenders were opened it was found that the lowest figure had been submitted by a firm that did not manufacture locally. The final result, however, was that a Toronto firm was awarded the contract at a higher figure. This is a bald statement of a somewhat long drawn out fight.

We have no criticism whatever to offer of the local firm that won. They presumably did what any good business firm would do—left no stone unturned that would help them to get the contract. The point at issue has nothing to do with who will supply the pipes. The real question is—was the Toronto city council honest? Is there not, after all, in business, such a thing as keeping faith? Are all municipal council agreements merely scraps of paper?

Calling for general tenders it [illegible] interpretation—every tender will be considered [illegible] the same basis. This meaning is [illegible] absolutely understood as if it were a fully stated [illegible] many words. The consideration of the tender offered by the outside firm was a further acknowledgement of this obligation. There is little doubt that the original intentions of the Toronto city council were to treat all alike, just as there is no doubt that the final act of council was due to losing sight of a basic principle. It is the kind of action that demonstrates the lack of ideals. It may not be an offence against the law, but it is an offence that lowers the city of Toronto in the eyes of other cities. It makes it impossible for the citizens of Toronto to be proud of the fact that they are citizens, and municipal acts of a large city like Toronto may well be taken as an example to guide the actions of smaller municipalities, such action must have the effect of lowering the moral standard of citizenship from one end of Canada to the other.

The Contract Record wants to be clearly understood as to its stand in this matter. We are pleased to see business go to the firm that was finally awarded the contract; we appreciate the strength of the arguments regarding local unemployment; we do not over-rate the claim that such a course will prevent outside firms from tendering in the future, but we are clear on this point—whatever an individual or a group of men agree to do, they must do. If outside tenders are not to be considered—say so. If a certain degree of preference will be allowed local firms—say so; but if we are men, if we want others to think us manly, we must play the part. The Toronto city council's action is such that it will cause regret to every fair-minded citizen.

Technical Schools Help Apprenticeship

An item which appeared some time ago, in a Buffalo, N. Y., newspaper indicates convincingly the manner in which the desires of contractors may be so linked in the public mind with the aims of trade schools as to present a clear picture of the movement to improve the labor situation within the construction industry and thus bring benefit to all who undertake building operations, even down to construction of the smallest home. The article follows.

Prominent contractors and builders of this city, as well as the Allied Building Trades Council and others, have endorsed the new courses in bricklaying, plastering and plumbing at McKinley vocational school.

The following prominent Buffalo business men praise the courses and say they are willing to employ those who graduate as advanced apprentices in their respective establishments.

J. H. Cowper, president of the John W. Cowper Construction Co., Inc., has the following to say in the matter:

"I am glad to learn that it has been definitely decided to establish trade courses in bricklaying, plastering and plumbing at McKinley vocational school and thoroughly endorse your idea and want you to know that I should be glad to help the furtherance of this in any way I can.

"As far as I am able to do I should be glad to give the boys who graduated from this school in these courses employment as advanced apprentices and rate them accordingly. I will also endeavor to arrange to give them during their school term certain hours of work in the trade in order that they may learn in a practical way more what they are [illegible]

"I am sure that this move will be welcomed and commended by all who are sufficiently familiar with what you are doing and of the prospect of having a number of boys not only given a good mental education but added to this

pathy with any movement that will increase the number of mechanics in the building trades and we know that they would express themselves in terms similar to those of Mr. Cowper, if courses were established in our own technical schools.

Experiments with Activated Sludge

Six Months' Operation of Test Plant at Hertford, Eng., Provides Valuable Data Regarding Aerating Action and Sludge Content

The incoming sewage is pumped from a tank fixed at such a level as to receive sewage from the sewer at the sewage works before it reaches the existing lime and chemical mixing chamber. A fine screen is fixed around the inlet to the supply pipe in the sewer to prevent any large flocculent matter entering the same. The sewage is pumped into a small hopper, from which a 2 in. G.W.I. pipe leads into channel No. 1 near the surface, and in such a position that it flows directly under the discharge from the air lift.

Pumping and Blowing Equipment

The pump and rotary blower are operated by a small petroleum engine. The great difficulty with such an exceptionally small plant as this is that a sufficiently small engine, blower and pump and suitable for running twenty-four hours a day week in and week out, could not be obtained, and the circumstances the number of stoppages due to temporary failure were remarkably few. The engine was a Petter semi-portable and was rated at 2½-b.h.p., but the actual power required by the pump and blower was estimated at less than 1-b.h.p.

The pump was of the "Ritt-Plunge" type and discharged about 5 gallons per minute. Such portion of the discharge as was not required to be delivered to the aeration tanks was by-passed and run to waste.

The blower was of the Reavell's rolling drum type, and rated to deliver about 30 c.f. of free air at 2,000 r.p.m. Running at about 1,350 r.p.m. the loss due to "slip"—i.e., leakage past the blades—is very high, and the volume of air actually discharged to tanks was 10 c.f., of which about 1 c.f. was taken by the sludge air lift, leaving 9 c.f. for the aeration tanks. It will be seen later that this worked out at about 3 c.f. of air per gallon treated, which agrees very closely with the amount found to be necessary for such small and shallow tanks where the time of contact between bubbles and liquid is of necessity very short.

These three units were really only suitable for running a few hours each day, but were the best that could be obtained for the purpose.

Particulars of Time Worked by Plant

The plant was started on April 13, 1922, at 11.30 a.m., and was worked for 5½ hours, after which it was stopped on account of Easter holidays. The plant was restarted on April 18th at 12 noon, and was worked intermittently until May 11th, usually from about 7 a.m. until about 10 p.m. The total number of hours the plant was worked during that time was 317. From May 11th the plant was run continuously, but owing to trouble with the engine this was not possible until after the 15th of the same month. After this trouble the plant was worked continuously, with

the exception of one or two days, when trouble was experienced with the engine, and also when it was necessary to de carbonize, until 10 a.m. on August 12th, when the blower gave out. The time the plant was working up to this date from the commencement was 2,420 hours, or 2,103 hours practically continuously. The blower was sent away for repairs, returned and refixed, and started again at 8 a.m. on September 14th, and run continuously as before until 9 a.m. on January 15, 1923, when the centre tank was removed—i.e., Nos. 2 and 5 channels removed—thereby reducing the capacity to two-thirds of the original—i.e., about 447 gallons.

The time that the plant had been worked up to this date from the commencement was 5,085 hours, of which 4,668 hours were practically continuous, except when stopped for repair of blower, &c.

The purpose for the remainder of the experiment was to ascertain the smallest length of aeration required for treating the Hertford sewage, which is a very weak sewage owing to being diluted with infiltration of ground water into the sewers, the dilution being about three times the calculated D.W.F. of the population served by the works.

Before the centre tank was removed the liquid and sludge in the aeration channels was run off into a large tank, and when the alterations were completed this was pumped back. The plant was started up again at 3 p.m. on January 15th, when some trouble was experienced with the engine. After repairing the engine the plant was only run for a few hours a day to keep the liquid fresh, as it was decided to stop experimenting because sufficient information had been obtained. The time the plant was working during the latter experiment was 1,421 hours.

Samples were taken periodically of the raw sewage, liquid in No. 6 channel, activated sludge from air lift, and the final effluent, and sent for analysis the results of which are given separately.

Results of Operation of Plant

When the plant was started on April 13th, 1922, the speed of the engine was 700 r.p.m., the blower 1,350 r.p.m., and the pumps 560 r.p.m., and these speeds were maintained as far as practicable during the experiments.

The method of working after the plant was restarted on April 18, 1922, was as laid down in the instructions issued by the makers of the plant—viz., Messrs. Activated Sludge, Limited, of Westminster.

(1) **The building-up Stage.**—The maximum volume the pumps could discharge was passed through the tanks continuously for as many hours as the engine was run. The air lift was regulated to return a volume equal to about half the volume delivered by the pump. This was continued until a sample of the liquid in No. 6 channel in a glass cylinder, after standing for one hour showed a sludge content of 10 per cent of the volumetric contents of the glass cylinder.

At 11 a.m. on—
27.4.22, after running 120 hours, sludge registered 2 per cent
1.5.22 " " 174¾ " " " 1½ "
At 3.30 p.m. on—
5.5.22 " " 236¼ " " " 6 "
At 10 a.m. on—
9.5.22 " " 287¼ " " " 10 "

At 11 a.m. on 11.5.22 the pump was stopped, but plant continued with aeration only in accordance with instructions, which were as follows:—

(2) **Aeration of Tank Liquid.**—When the 10 per cent of sludge has been obtained the pump discharge should be stopped but the air lift should be operated at full capacity. The aeration should be maintained continuously day and night until a sample taken from the settlement tank shows traces of nitrification on test with Griess Illosvay solution "A" and "B," or effluent on test shows only traces of ammonia.

The test for nitrification.—To 50 c.c. of effluent add 1 c.c. of Griess Illosvay Solution "A" and 1 c.c. of Griess Illosvay Solution "B." Allow to stand for 10 to 15 minutes. A pink coloration shows nitrification is taking place.

The results were as follows:—

At 11 a.m. on 11.5.22, when the plant had been working 320½ hours, the aeration period commenced.

At 3 p.m. on 11.5.22, after aerating for four hours the sludge registered 16 per cent.

At 11 a.m. on 17.5.22, after aerating for eighty and a half hours, the sludge registered 19 per cent, and remained 19 per cent until 11 a.m. on 21.5.22, when it registered 20 per cent.

At 11 a.m. on—
21.5.22, after aerating for 193¼ hours, sludge registered 20%
22.5.22, " " " 217¾ " " " 21 "
24.5.22, " " " 256 " " " 22 "
24.5.22, " " " 256¼ " " " 23 "
25.5.22, " " " 278¼ " " " 24 "
26.5.22, " " " 302 " " " 24 "
27.5.22, " " " 326 " " " 25 "
29.5.22, " " " 371 " " " 25 "
31.5.22, " " " 137 " " " 25 "
1.6.22, " " " 161 " " " 24 "
2.6.22, " " " 185 " " " 22 "
3.6.22, " " " 509 " " " 24 "
4.6.22, " " " 533¼ " " " 23 "

On the 6.6.22 the test showed that nitrification was taking place, and at 4 p.m., after aerating for 286¼ hours, the pump was restarted.

During the period of aeration it had been found necessary, owing to evaporation (plant being in very exposed position), to occasionally add a small quantity of sewage.

At 4 p.m., 6.6.22, pump discharged ¼ gallon per minute, sludge returned at 1/8 gallon per minute.

	Gal. Per Min
At 9 a.m.—	
7.6.22, after running 17 hrs. pump discharge increased to	½
At 3 p.m.—	
7.6.22 " " 23 " " " "	¾
At 6 p.m.—	
7.6.22 " " 26 " " " "	1
At 9 a.m.—	
8.6.22 " " 11 " " " "	1½
At 3 p.m.—	
8.6.22 " " 47 " " " "	2½

and in all cases the volume of sludge returned by air lift was regulated to half the volume of discharge by pump. Also before an increase of sewage was made the test for nitrification was maintained.

The plant was worked at this until July 11th, when it was found on testing discharge that the sewage passing into No. 1 channel was 2 gallons per minute, and the returned sludge at 1 7/8 gallons per minute, this drop in pump discharge being properly due to the efficiency of the pump decreasing. The discharge was regulated to 2½ gallons per minute and plant continued working as before until July 24th, when the discharge from pumps was increased to 3 gallons per minute and the returned sludge by air lift to half that volume. This was continued until the blower gave out on August 12, 1922.

When the plant was restarted at 8 a.m. on September 14th the liquid in the aeration channels and settlement tank was agitated and the air lift worked at full capacity until on testing for nitrification it was obtained at 3 p.m. on the same day. As it was found at 3.45 p.m. to be strong, at 4 p.m. the sewage was passed into the channels at the rate of 7/8 gallon per

between the channels 1, 2, 6 and settlement tank became partially blocked at different times, thereby causing a loss of sludge owing to washing over sides of channels, with the result that at 11 a.m. on November 11th the percentage of sludge was 2 per cent nitrification good and effluent clear. The sludge built up rapidly, until on the 14th it was 11 per cent, on the 15th 14 per cent, and on the 16th 16 per cent, with nitrification good and effluent clear in each case.

The plant continued to work as before until January 15, 1923, when the capacity of the aeration tank was reduced to two-thirds—viz., 447 gallons.

After taking out the middle tank on January 15, 1923, the plant was re-started at 3 p.m. by pumping back the liquid previously run off into the suction tank, and the discharge into the aeration channels was started with a small quantity and gradually increased until it was 2 1/2 gallons per minute on the 17th, with the sludge returned by air lift regulated to 1 3/4 gallons per minute. This discharge was maintained until January 22, when the engine gave trouble, and it was found that renewals were required. The plant was re-started at 3 p.m. on the 26th, and liquid in channels, &c., aerated for three hours, and at 6 p.m. it was found that nitrification was good and the discharge of sewage was started at the quantities stated above. The plant continued to work until March 23rd, when the experiments were stopped.

During the working of the latter experiment it was found that the plant (except settlement tank, which was still too small) was quite capable of dealing satisfactorily with the quantity passed through.

Schedule Showing Time Plant Worked to the Taking of Each Sample

(The times are taken from the time that nitrification was present in all cases).

No. of sample	Date	Quantity of Sewage (gals. per min.)	Quantity of sludge returned (gals. per min.)	Percentage of sludge	Nitrification	Effluent	No. of hours Worked
1st set	8.7.22			14	fair		632½
2nd set	11 7.22	2 1/7th	1/78	10	good		824½
3rd set	26.7.22	3	2 1/7th	17	good	clear	1,181½
4th set	11.8.22			17	good	clear	1,526
5th set	26,9 22			15	good	clear	282
6th set	11.10.22	2½	1 1/4	16	good	clear	610½
7th set	27.10 22	4	2	12	good	clear	983½
8th set	15.1.23			18	good	clear	2,825

*Plant worked twenty-four hours after this, until blower gave out on 12.8.22.

Samples for reduced capacity of aeration channels

9th set	27.2.23	2½	1¼	13	good	clear	860
10th set	15,3.23	2½	1¼	13	good	clear	1,241½

Schedule of time of stay in aeration channels and settlement tank for varying rate of sewage discharge

Sewage gals. per minute	Returned sludge (gals per min.)	Length of stay in aeration channels	Length of stay in settlement tanks
		H.M.	H.M.
2	1	3.43	0.31 1/3
3	1½	2 27	0.21
4	2	1.52	0.15 2/3
For reduced capacity of aeration tanks—447 gallons			
2½	1¼	2.0	0.25

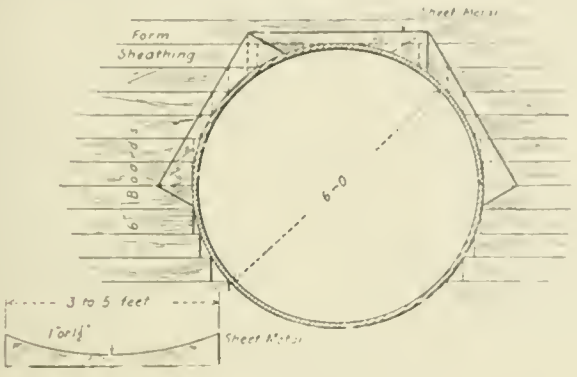
Hints for the Contractor

Fitting Formwork Around Tanks

Today when form costs run high even at best, any method which will save time and labor is well worth considering.

In a job involving the installation of two large water supply tanks of steel, H. W. Eldridge, an engineer and contractor of New York, N. Y., developed a useful way of fitting the formwork around the tanks, which is described in "Contractor's Atlas."

The two tanks were each 30 ft. long and 6 ft. in diameter, supported at each end by concrete walls. In order to make a neat job of the framework so that the concrete would have a good appearance, it would have been necessary to spend considerable time cutting and fitting the boards to the circle of the tank—in fact, to do a very good job would have meant cutting the ends on a band saw. To do away with the



How slab forms were fitted to circle

fitting operation, sheet iron plates cut to the proper radius were used to make a tight fit around the tank. These pieces each forming part of the required circle were cut from scrap pieces of black iron of about 18 gauge by the local sheet metal worker. The form boards were cut with square ends, nailed to the studs in such a manner that the space between the square end of the form board and the outside of the tank was not over 2 in. The sheet iron pieces were tacked to the inside of the form. The sheet iron pieces were of varying lengths, depending on the scrap available. The only fixed dimension in the piece of sheet metal is the proper radius and the provision of at least 2 in. at the narrowest portion. This method resulted in a saving of $4.00 per cu. yd. of completed concrete on this portion of the work.

Advantages of Aftercooling Compressed Air

By F. A. MacLEAN

Under most conditions atmospheric air contains more or less moisture. When this air is compressed and cooled much of this moisture is precipitated with a resulting shrinkage in volume and the loss of the power consumed in compressing the vapor. This condensation process takes place in ordinary pipe lines as used around plants, because of the radiation of heat to the atmosphere.

It is a well known fact that moisture in air pipe lines ultimately reaches the drills or tools. The moisture has two detrimental effects. First, it washes away the lubricating oil causing excessive wear in the drills with the high maintenance charges. The second trouble is that due to the low temperature caused by expansion of the air in the tool, this moisture freezes in the valves, ports, etc., greatly interfering with the operation of the drill or tool.

Production is retarded if not stopped altogether by this accumulation of ice. It has been found from experience that it pays to keep pneumatic equipment working at full capacity as much of the time as possible, even though it may require additional outlay for equipment and power to do so. In most compressed air plants where the air is used for operating rock drills or pneumatic tools it, therefore, pays to eliminate the troubles caused by moisture.

Two methods are available; one to take into the compressor dry air only and use it at the tools with as little loss of heat as possible. This is the ideal solution, but physically impossible. The second method is to remove as much moisture as possible from the air after it has been compressed, and before it is used in the tools. This can be most readily done by means of an aftercooler which simply reduces the temperature of the air compression and precipitates the major part of the moisture.

Due to the reduction in temperature caused by cooling the air, there is also a reduction in volume. This means that a smaller volume has to be transmitted through the pipe line which in turn means a lesser pressure drop, or a saving in power. This saving in power partially affects the loss in internal energy caused by the reduction in temperature during the process of cooling.

In addition to the foregoing advantages for the use of an after-cooler, there is another which is worth consideration and that is, less expansion of the pipe lines due to the uniform and low temperature of the air entering same. Still another advantage is the precipitation of lubricating oil at a point where it can be easily drained from the system, reducing the rotting of rubber gaskets and hose if used. The advantages may be summed up as follows:

(1) Elimination of freezing troubles.
(2) Less wear on drills or tools.
(3) More production from men and tools.
(4) Less pressure drop in lines which means more work for the same power expended in compressing the air.
(5) Elimination of expansion strains in pipe lines.
(6) Removal of oil from air.

British Cement Industry Not Controlled by U. S. Capital

A few weeks ago it was reported that the controlling interest in the Associated Portland Cement Manufacturers, Ltd., which controls capital to the amount of £13,000,000, and nearly 90 per cent. of the

British cement industry, has passed to a newly registered company called the Associated Anglo-Atlantic Corporation, whose chairman is Sir Philip Nash. It was said that this indicated that U. S. capital would dominate the British Cement industry. This is now denied by Brig.-General Stanley, chairman of the Associated Portland Cement Manufacturers, who has returned from a visit to the company's works in British Columbia. He says: "I definitely state that reference to American control or management are entirely untrue and I have the authority of the chairman of the board of the Associated Anglo-Atlantic Corporation that their company is an entirely British concern. Sir Philip Nash, chairman of the board of the Associated Anglo-Atlantic Corporation, has requested me to say we are working in friendly co-operation."

Quarry-Run Stone for Exterior Walls

The erection in the past two or three years of numerous college, institutional and church buildings in which the dominant architectural feature has been carried out through the use of rough sawed, quarry-run Indiana limestone for the random ashlar field work of exterior walls has served to heighten the interest of the public in this form of stone work, states a recent article in "Stone." The resultant effect obtained in this random ashlar treatment of walls is especially pleasing where the surroundings of trees, lawns and driveways is possible and for this reason it has unusual possibilities in residential construction, especially where the plot is of sufficient size to admit of landscaping. Quarry producers find that architects are very much interested in both the effects and the economy of this class of masonry work and that they are using it in an ever increasing number of buildings, and especially in those districts where masons are available to set the stone.

Random ashlar, as the name implies, means that the joints are irregular—that the strips of rough sawed, four-sided material, as furnished by the quarry producer, are broken off irregularly to the lengths required on the job. Such a wall facing is essentially a mason's job and should be treated as such, rather than as cut stone trim. While in the larger structures such as college buildings and churches, cut stone trim is almost essential, it can be employed without trim in small houses of moderate cost. The economy in the use of quarry-run stone lies in the fact that no stock is discarded for blemishes that do not constitute structural defects. This, of course, enables the producers to fill orders without regard to selection for color, texture or length of blocks, a process that adds much to producing costs.

Freedom of use is the chief attraction of this quarry-run stock. It enables the architect to work out an idea of solidity with a maximum textural effect and with a full range of color. In the matter of trim the designer is enabled to turn simplicity into dignity through the concentration of cut stone trim at entrances, on towers and around windows. These are focal points and frequently are overlooked as means of promoting handsome decorative effects. Quarry-run stock, then, may be said to bridge the gap that has long existed between cut stone and the rougher field stone masonry, although it is inclined to follow the latter in methods of setting and is best handled by masons acquainted and accustomed to broken joints and varying widths of raked out mortar joints. These mortar joints range in width from three-fourths to more than an inch, dependent upon the architect's specifications. Being sawed for size the stone is delivered to the job in much more accessible shape than is the usual run of field stone and for this reason its development has been to replace rough textured brick and hand dressed stone.

The Week's Developments in a Nutshell

Roger W. Babson, the U.S. statistician, has lectured during the past week in both Montreal and Toronto. He is neither optimistic nor pessimistic. In that he is in accord with Professor Mitchell whose most recent curves show a decided tendency to oscillate within very narrow limits. The outlook for 1924 according to both these students of economics may be said to be a repetition of 1923.

Mr. Babson admits that many industrial and financial authorities in his country do not agree with him—they are much more optimistic. This refers particularly to the steel industry where the 1923 operations have been considerably better than was expected (in Canada, almost double the figures of 1922) and where anticipations are freely made that next year will see further improvements.

Further to this, sentiment as regards the banking situation is much improved. All the annual statements coming through are demonstrating the sound positions of the banks and the public is now apparently convinced there will be no further troubles in that quarter.

A decidedly favorable factor in the future outlook is the more liberal policy of the Dominion government regarding immigration. In his address Babson emphasized the uselessness of natural resources without the necessary man power to develop them. The Minister of Immigration and Colonization, Hon. Mr. Robb, states that the regulations regarding immigrants have not been so lenient for many years as they are now.

The labor and material situation remains almost unchanged. Iron and steel prices have stiffened again slightly but this is about offset by small recessions in two or three lumber lines. Open weather has kept labor well employed. Retailers are very optimistic for Christmas trade and, in general are making plans for a December business about twenty-five to thirty per cent in excess of last year. A retail shoe house states that November turnover was twenty-five per cent better than November, 1922, and a large electrical firm's business for the first ten months is forty per cent ahead of the same period a year ago.

Knowing His Costs is the Dealer's Salvation

The Supply Man Who Guesses at Costs is a Detriment to the Business—Success Demands Knowledge

By EDWARD K. CORMACK*

If it required any one fact to demonstrate that man is still a long ways from being the thinking animal he calls himself and therefore entitled to be classed as an intelligent being, it is his attitude towards what are termed costs.

Cost may briefly be defined as what you have to pay for anything, real or unreal, tangible or intangible. A man cannot ignore the natural law governing his physical life without having to pay and what he pays is the cost of that particular pleasure, and I can understand a man taking a chance on this kind of debt, in the hope that it will not be heavy, better than I can understand the ignoring of what might be called "mathematical costs" in the consideration of which there is no gamble and no doubt, when even the Supreme Architect (and this is said with all reverence) cannot escape from being compelled to give consideration of and adherence to the working of all laws governing mathematical costs.

Dangerous Fools That Rob All Business

Of all the fools allowed to run around loose on this earth, the prize boob is the so-called business man who guesses at his costs, and this particular kind of fool is not a harmless half-wit; he is a real and dangerous maniac because, in his ignorance and disregard of all the fundamentals entering into the great subject of cost, he makes it impossible for his competitor who has a true understanding of the subject to exist, and in this respect the fool referred to is dangerous to the community, and some day the state will realize that it has the same moral and legal right to put him under restraint as it would have did it catch him running up and down the street with a knife in his hand, slaying all he came in contact with.

If the individual's managing and selling methods are not efficient, are not what they ought to be and could be, no amount of co-operation with his fellow business men is going to make his business profitable.

The only excuse for going into business is to make money. The money thus made is profit and profit is the difference between raw cost plus manufacturing, delivering and executive expense, and the amount received for the completed article or service.

Did I hear a voice from the rear say, "Any fool knows that"? My dear sir, you are wrong, for I know many fools, big and little, in the supply business who do not know it.

These gentry are not cost finders—they are guessers, and poor guessers at that! They price the value of their goods and service at an arbitrary figure largely based upon what their competitors are doing. The blind leading the blind.

When Edward N. Hurley was chairman of the U. S. Federal Trade Commission he preached incessantly, "Know your costs." At that time I wondered why he harped so much on the one text. Now I know. The evidence of the drunken indifference of the business man to this all-important factor of profit safety was daily laid on his desk in such staggering magnitude and the effects so appalling that he could not do other than cry out, "Know your costs."

Since I have been business counselor for the National Builders' Supply Association I am beginning to feel a good deal like Mr. Hurley did.

I wish I could, without breach of confidence, tell of some of the letters daily being received in reference to the troubles of the building supply industry.

They come from large as well as small cities, from men nationally known in the industry and from men I have never heard of. Without exception, they all carry the same tale of woe, on the principle, I suppose, that only those sick consult the doctor. It has ceased to be a joke. It is a tragedy, so much so that the head of one of the largest firms in the country winds up his letter by asking, "Is there any place in the scheme of things for the building supply dealer?"

Putting the Dealer Question Up to Einstein

I suppose it's the simplicity of the thing that makes it so hard to put over. The dealer wants to be saved, he can be saved, but he won't permit himself to be saved. Puzzle it out; it's a problem worthy of Einstein.

Now I don't care what kind of cost system you use any more than I care what make of compass a vessel has on board. My only concern is that it be accurate.

Some time ago I was in the office of a dealer and this question of costs came up. He said he could sell and deliver a certain commodity for fifty cents per unit. I knew he couldn't and said so. We argued and finally agreed that for a period of one month the actual delivery charges on this particular commodity should be the subject of special attention and record. At the end of the period I received from him a statement showing the delivery charges alone were seventy-four and four-tenths cents per unit and this did not include warehousing, selling and executive expense.

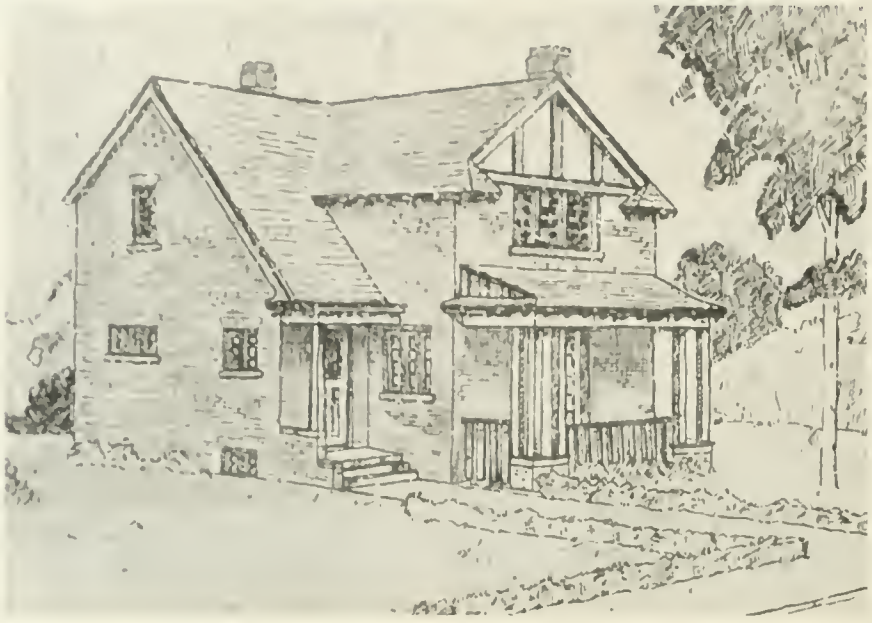
It's enough to make angels weep

Floundering, blundering, snarling, fighting, blam-

(Continued on page 1167)

*Business Counsellor, National Builders' Supply Association, in "Building Supply News."

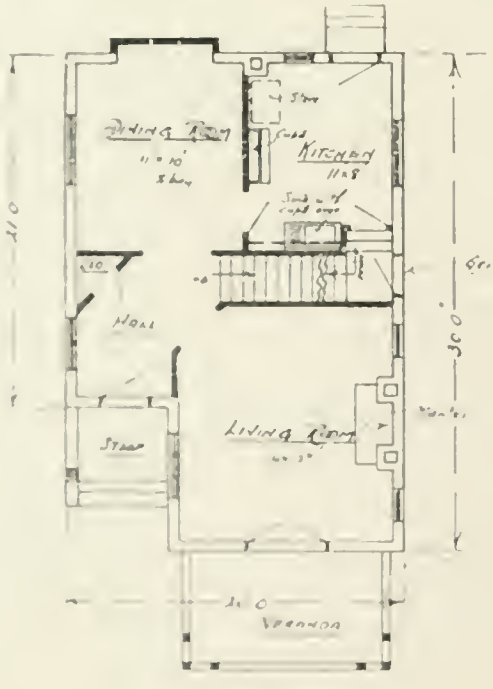
The Contract Record's
Weekly House Suggestion No. 91

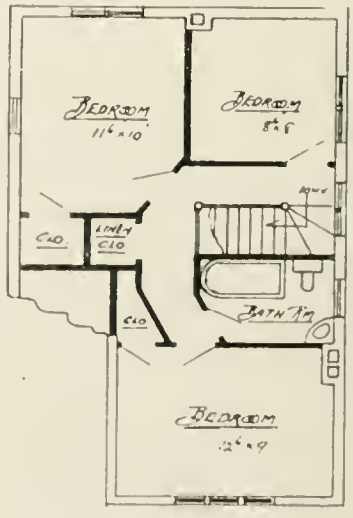


This design is representative of a number of small, detached, 6 room residences being erected by Duncan Murray, on the Gartshore Estate, North Toronto. The houses are all detached and are laid out two on a 52 ft. lot with a central drive. The plans shown are used in all the houses, but the exterior is varied in each case. The first floor layout is so arranged as to keep hall and stair space down to the minimum. There is a nice sized living room, equipped with mantel and opening on an enclosed verandah at the front. The kitchen has entrances from the side and from rear. The floors are of hardwood, as is the trim in the hall, living room and dining room.

There are three bedrooms and bathroom upstairs, trimmed in pine, white enamelled. The flooring here is of hardwood also. The houses are all wired for electric ranges, which will be installed by the builders. The heating system is of the hot air type.

Messrs. J. Hunt Stanford & Son, architects, Yonge St. Arcade, Toronto, are the designers of these houses.





Knowing Costs is the Dealer's Salvation

(Continued from page 1165)

ing others for woes resulting from the dealer's own careless neglect. Is there nothing that will shake his mind out of the torpid trance it is in, so he may take his rightful place among the useful and necessary industries of the country?

Will he not realize that the dangerous competition which saps the life blood of an industry results from a lack of knowledge of "costs?"

If you would acquire the A, B, C of successful co-operation, know, don't guess, your costs and assist your competitor to know his.

O. O. Lefebvre Talks on Storage Reservoirs

The Ottawa branch of the Engineering Institute of Canada was addressed on November 15 by O. O. Lefebvre, M.E.I.C., chief engineer of the Quebec Streams Commission on the subject "Storage Reservoirs in the Province of Quebec." He explained the method of constructing and operating storage reservoirs for power development and indicated how such projects are financed and how the rates are determined. The lecture was illustrated with lantern slides.

Mainly Constructional

East and West—From Coast to Coast

Mr. George Brigden, chairman of the Ontario Division of the Canadian Manufacturers' Association, in an address before the association at Toronto recently, urged that engineers and architects specify home products in the construction of buildings, which, he stated, were as good as any in the world.

Mr. D. W. McLachlan, engineer in charge of the proposed St. Lawrence ship canal, when addressing the annual dinner gathering of the Peterboro branch of the Engineering Institute of Canada recently, appealed for a united Canadian engineers' opinion to meet the united American opinion on the question of carrying through of the project with only one dam. This plan would not endanger the safety of the people of Montreal, he said.

On account of the frequent breaks in the watermains in Quebec City, it is proposed to appoint a board of engineers to investigate the condition of the entire system.

The Dominion Truck Equipment Co. Ltd., of Kitchener, Ont., have opened an office in Montreal, at 10 Victoria St., with R. V. Clark as their district representative. The Dominion Truck Equipment Co. manufacture trailers, hoists, dump bodies and truck units, and the increase of their business in the province of Quebec has made this step necessary.

Messrs. Pennington and Boyde, prominent Windsor architects, have completed the drawings for the new St. Peter's Seminary in London, which will cost about $500,000.

The design of a war memorial monument, prepared by Mr. Alfred Howell, director of art at the Central Technical School, Toronto, has been chosen by the city of Guelph. The monument will cost $25,000.

Plans have been completed and approved for a new building to be erected by the Ursuline Sisters on a 90-acre site adjoining the University of Western Ontario, at London, Ont., in which the work of Brescia Hall, a ladies' seminary affiliated with the University, will be continued. The plans call for a three-storey stone building of Gothic architecture to accord with the main university group. Tenders are to be called for at once and it is estimated that the cost of construction will be $250,000.

According to a recent announcement made by Colonel Thomas Vien, K.C., M.P., the [illegible] on the Quebec Bridge has been decided upon but [illegible] regarding the contributions of the Federal and Provincial Governments remain to be settled by negotiations which are already in progress.

The construction of fireproof vaults and buildings was discussed by W. A. Robertson, local engineer, before a recent luncheon meeting of the Hamilton Architects' Association in the Royal Connaught hotel. He stressed the ever increasing extent of fireproofing in modern building.

A recent report states that the Long Lac-Nakina cut off for the Canadian National Railways, was completed a few days ago. The work has been in progress for 11 months and has employed from 200 to 1,200 men continuously. A remarkable feature about this work was that not a single accident of a serious nature occurred.

An interesting piece of engineering work designed to improve navigation on the Yukon river is being done this year by the White Pass Transportation Company. The source of the river is a number of great lakes, fed from melting snows, that do not fill up until late summer, thereby causing low water in the river in spring and early summer months. At the foot of Marsh lake the company is constructing a great dam, the top of which will touch high-water mark. This will hold back water for use when it is needed and when the rivers of northern Yukon are in flood. It is expected by this means to cut out the annual spring navigation delays. The plan for the dam was investigated and approved by dominion government engineers.

During the season just closing, 51 miles of road were built in Renfrew County, Ontario, including grading 23¼ miles; surfaced with gravel 14 2.3 miles; surfaced with macadam 13 miles. In addition, there were built 69 culverts of varying sizes and a number of pipe culverts. The quantities for this were, approximately, excavation of rock and stone 138,000 cu. ft., gravel 26,415 cu. ft. and crushed stone 39,000 cu. ft. The usual amount of maintenance work was carried out and 31 3/5 miles of macadam road were surface treated with liquid asphalt.

Personal

Mr. J. Hubert Dougherty, Toronto Manager of the General Supply Company of Canada, Ltd., has been transferred to the management of the Montreal office. Mr. W. H. Qua will succeed Mr. Dougherty as manager of the Toronto office.

Mr. Richard W. Yerkes, formerly general manager of the Philadelphia plant of the Link-Belt Company, has been appointed to succeed Mr. B. A. Gayman as treasurer of the company. Mr. Yerkes will be located at the general offices of the company, at 910 South Michigan Ave., Chicago.

Messrs. Viau and Venne, architects, formerly at 76 St. Gabriel St., Montreal, have moved to 99 St. James St.

Trade Incorporations

A recent registration at Montreal is Dubreuil & Prezeau, to manufacture cement blocks.

Jackson Construction Co. Ltd., with head office at Winnipeg, capital $100,000, to carry on a general contracting and building business.

The Balsas Dredging Company, Ltd., with head office at Vancouver, B. C., capital $100,000.

Mollison Construction Co. Ltd., with head office at Winnipeg, Man., capital $30,000, to carry on a building and contracting business.

CONSTRUCTIONAL ACTIVITY

Period of November 28 to December 4, 1923

Dominion Wide Service Exclusive to "Contract Record & Engineering Review"

Waterworks, Sewerage and Roadways

Cloverdale, B. C.

Surrey Sewer Construction has decided to construct a sixth cr west side of [illegible], 5 ft by 1,500 ft [illegible] will shortly be called

Logan Twp., Ont.

Tenders for the laying of Parrott' [illegible] will be received till December 11 by the municipal council Brodhagen, [illegible] Louis Taco Rock, R. R. No. 3, Barrhaven, Ont 10% marked cheque required

McKillop Twp., Ont.

Tenders are being received till December 14 by Jos McNay, Clerk, township council, Seaforth, Ont., for laying of 2½ mile drain Plans at lot 25, con. 3 McKillop Twp, Ont N 10% marked cheque required

Sturgeon Falls, Ont.

Work is expected to start next year on a new road from Sturgeon Falls to Cobalt, Ont.

CONTRACTS AWARDED

Coteau Station, Que.

St. Lawrence Water Co. have awarded the general contract for $10,000 waterlines to Jos. Dents, Coteau Station. Engineer in charge of work is Oscar [illegible], 252 Bord Du Lac, Point Claire, and is in the market for cast iron pipes, 6 in. or 8 in.

Montreal, Que.

[illegible] Lapierre, on Lowardaire, has been awarded the contract for grading Sherbrooke St. E., extension, at $87,000 and is in market for 1 air compressor

Metapidia, Que.

Work is in progress for gravel road to Grand Lake, 12 miles long, J. Adams, Metapedia, Que., is the general contractor.

Oshawa, Ont.

The contract for pump and motor has been awarded by the Board of Water Commissioners to De Laval Co. Ltd. 13 Richmond West, Toronto.

Toronto, Ont.

The following have been awarded contracts for sewers by the city of Toronto: J. H. Knight Construction Co., Morgan Contracting Co., P. Lucastro, [illegible] Dufferin St.

Railroads, Bridges and Wharves

Chantry Island, Ont.

Plans are to be prepared for harbor improvements here, to cost $50,000

Grand Mere, Que.

The erection of a wharf to cost $15,000 is proposed by the city council. Engineer in charge of work is B. Grand Mont Three Rivers, Que.

Peterboro, Ont.

Tenders are being received till January 22, 1924, by the county council, through the clerk, Ed. M. Elliott, for the construction of a concrete arch bridge at Lakefield, Ont. Plans and specifications may be seen at the offices of the county clerk, Peterboro, Village clerk, Lakefield, and office of the engineers, A. W. Connor & Co., 34 Victoria St., Toronto.

Saugeen Harbor, Ont.

Plans are to be prepared for harbor improvements estimated to cost $120,000 which will include, dredging, remodelling and extending piers, etc.

Shawville, Que.

Work is to start shortly for bridge to be built over Mill Creek near here.

CONTRACTS AWARDED

Aubert Gallion, Que.

The following trades have been let on $100,000 steel bridge being erected here; piers and abutments—Chas. Jolicoeur, Beauceville; structural steel—Phoenix Bridge & Iron Works, Ltd., Montreal. Engineer in charge of work is Ivan E. Vallee, Parliament Bldgs., Quebec.

New Westminster, B. C.

Fraser River Pile Driving Co., Ltd., have been awarded the contract for extension to wharf at $2,964.87.

Three Rivers, Que.

The contract for repairs to Bureau Wharf has been awarded by the Three Rivers Harbor Commission, to Bourassa Clifford Corporation, Ltd., at $8,000.

Public Buildings, Churches and Schools

Burlington, Ont.

The city council contemplate erecting a municipal building and fire hall combined

Fredericton, N. B.

Tenders for the erection of a seed extracting plant will be received till December 21, by the Dept. of Lands & Mines, through the minister, C. W. Robinson, Crown Land Office. Plans and specifications with minister. 5% accepted cheque required.

Grande Vallee, Que.

Pierre Levesque, architect, 115 St. John St., Quebec city, is preparing plans for alterations and finishing of church to cost $25,000. Tenders will be called in February of next year

Grand Valley, Ont.

The Latter Day Saints Congregation of Grand Valley, will erect a new church here. Tenders will shortly be called for masonry, metallic ceilings, furnace and seating. All applications may be sent to J. T. Thompson, R.R. No. 4, Grand Valley, Ont.

Hamilton, Ont.

Liberal Conservative Association contemplate building a hall in the southern section of this city.

Kingston, Ont.

W. Newlands & Son, Royal Bank Bldg., are preparing plans of $350,000 dormitory gymnasium on Russell St., for Regiopolis College.

Montreal, Que.

Tenders are being received till December 5 by the city council through the executive committee, for electric wiring, plumbing, heating and ventilating for city hall. Architect, Louis Parent, city hall.

Ottawa, Ont.

Tenders are being received by general contractors, Taylor & Lackey, Trust building, on sub-trades for $24,084 botanical laboratory. No closing date set.

St. Ferdinand D'Halifax, Que.

The erection of a convent here is contemplated by the Sisters of Charity.

St. Thomas, Ont.

Sarrach & Findlay, 430 Talbot St., are preparing plans of $40,000 public market to be built corner Talbot and Manitoba Sts. By-law covering this work is to be submitted to ratepayers early in December.

Toronto, Ont.

Darling & Pearson, architects, 2 Leader Lane, are receiving tenders till December 15 on all trades for addition to Toronto General Hospital. All tenders must be submitted on form of tender supplied by architects. Plans and specifications with architects.

H. N. Dancy & Son, 22 College St., are submitting a bulk tender and want prices on sub trades, except masonry, in connection with addition to Toronto General Hospital, University Ave.

Wickson, Gregg & Brydon, Temple building, are preparing plans of $25,000 church to be erected on Ranleigh Ave., for Bedford Park Presbyterian church

Trail, B. C.

Tenders will be received from December 15, 1923, till January 15, 1924, by Trail Memorial Building Society, Inc., through the chairman, B. A. Stimmel, for the construction of a $25,000 Memorial Hall here

Winnipeg, Man.

Plans are being prepared for $100,000 Cadet College to be built corner Portage and Dominion Sts., for Salvation Army,

J. N. Semmens, 509 Great West Permanent Loan Bldg., Winnipeg, is the architect.

CONTRACTS AWARDED

Bellevue Park, Ont.
Foundations are in for $22,000 church for R. C. Corp. of St. Bonaventure. N. Normand, St. Patrick St., Ottawa, has the contract for plastering. General contractor is J. B. Daoust, Westboro. Architects, Brodeur & Pilon, Hull, Que.

Burnaby, B. C.
Percy & Weedon, 2105 Kingsway, are the general contractors for $6,471 addition to Edmonds school here. Architects, Bowman & Cullerne, Vancouver. Electric, plumbing, heating, plastering, glazing trades not yet let.

Cardston, Alta.
The general contract for $146,000 school to be built here, has been awarded to Claydon Co., Ltd., Winnipeg, who will purchase materials and sub-let trades.

Fredericton, N. B.
The walls are up for $125,000 memorial building being built here for University of New Brunswick. Following sub-trades have been let: electric—Vaughan Electric Co., St. John; heating— W. J. Shea, 80 Carleton St.; plumbing—H. W. Thorne, Phoenix St. Both of Fredericton. Architect, F. Neil Brodie, 42 Princess St., St. John; general contractors, B. Mooney & Sons, 112 Queen St.

Haileybury, Ont.
The walls are up for $150,000 court house on Main St. Following sub-trades have been let: ornamental iron—Canadian Iron Co.; painting—F. G. Roberts & Co., Ltd. General contractors are Dickie Construction Co., Ltd. All of Toronto.

London, Ont.
The walls are going up for $18,000 parish hall for St. George Anglican Church. F. Cotton, 78 Empress Ave., has the contract for heating and plumbing. W. E. Dodd, 448 King St., is the general contractor. Architect, John M. Moore, 489 Richmond St.

Mount Royal, Que.
E. Tramblay, 13 Perrault Lane, has the roofing contract for $12,000 church hall being built on Stratford Rd. for Church of England. Electric to be let. Bremner Norris & Co., Montreal, are the general contractors. Architect, F. G. Robb, 127 Stanley St., Montreal.

Montreal, Que.
N. Lapierre, 518 Fabre St., has the plastering contract for school being built for Parish St. Pierre Claver. General contractor is J. C. Frenette. Architects, Bernier & Despatie.

Smith Marble & Contracting Co. have the contract for marble and tiling in connection with $228,111 school being built on Rielle St., Cote St. Paul. General contractors are Jas. Shearer & Co.; architect, J. S. Archibald, 314 Dorchester St. W.

Quebec, Que.
The contract for alterations to heating system of Examining Warehouse has been awarded to Brousseau & Frere, 321 St. Paul St., Quebec at $6,600.

Sackville, N. B.
The general contract for building post office here, has been awarded to J. P. Powers Construction Co., St. John, N. B., at $29,800.

Toronto, Ont.
The walls are going up for $61,000 sunday school and church for Ossington Ave. Baptist Church. Electrical work— Harry Alexander, Ltd.; plumbing and heating—A. R. Read, 662 Shaw St. Architects, Shepard & Calvin.

Victoria, B. C.
Luney Bros., Ltd., have been awarded the general contract for $150,000 high school to be built here. Architect, C. Elwood Watkins, Broad St., Victoria.

Windsor, Ont.
Jos. L. Heaurex, Wyandotte St., has the plumbing and heating contract for laundry and bed rooms to be built for St. Mary's Academy, costing $36,000. General contractor is Urgel Jacques, 600 Dougall Ave.

Business Buildings and Industrial Plants

Edmonton, Alta.
Canada Creosoting Co., Ltd., of Toronto, Ont., contemplate erecting a creosoting plant here.

Fort William, Ont.
Canadian Pacific Railway contemplate building an hotel here to cost $700,000.

Kincardine, Ont.
J. B. Watson Furniture Co. contemplate an extension to their factory to cost $20,000. By-law will probably be submitted to ratepayers shortly.

Kemptville, Ont.
McMaster Lumber Co., Ltd., are having plans prepared for altering power house for mill at a cost of from $3,000 to $4,000.

Magog, Que.
W. G. Stock contemplates building an $8,000 garage on Main St.

Middleton, N. S.
Massey-Harris Co., Ltd., will build a warehouse here. Local tenders will be called in spring.

Montreal, Que.
The walls are going up third floor for $125,000 office building on Victoria Pier, owned by Harbor Commission. Roofing, plastering and elevators to be let. General contractors are Collet & Freres, 243 St. Hubert St. Architect, T. Daoust, 61 St. James St.

Port Arthur, Ont.
United Grain Growers, Ltd., of Winnipeg, are planning an addition to their elevator here estimated to cost $1,200,000. This will increase the capacity of their elevator by 1,000,000 bushels.

Prince Rupert, B. C.
Plans are being prepared for erection of an apartment block on Third Ave. at a cost of $30,000. Arthur Brooksbank, Prince Rupert, is the owner. Work will start in the spring.

Quebec, Que.
Raymond & Dionne, 70 Lahberte St., Quebec, Que., are preparing plans of $30,000 club hall to be built corner Fleury and Crown Sts., for La Garde Champlain.

Toronto, Ont.
[illegible] to be erected [illegible] Toronto [illegible] Dundas [illegible] corner of Yonge and Dundas [illegible]

Tenders are being received by the owner, F. McGillivray, Carrell Hotels, Yonge St., Toronto, [illegible] and sheet metal work in connection with addition to "Carrell" Hotel, Yonge and Gloucester corner. Cathcart Apts. and Yonge St. Architect, Murray Brown, Confederation Life Bldg.

Victoria, B. C.
Work has commenced by Wilson shingle mill owned by Canadian Puget Sound Lumber Co.

CONTRACTS AWARDED

Barrie, Ont.
R. F. Garrett has the general contract for factory to be built on Maple Ave. for Warren & Ryan Co.

Hamilton, Ont.
Pouring concrete on 7th floor is being done on new Lister Building. F. G. Roberts & Co., 106 Wellington St., Toronto, has the painting contract and J. & G. Irving, 206 Locke St., Hamilton the roofing contract. General contractors are Pigott-Healy Construction Co. Architect B. H. Prack, Bay St., Toronto.

Montreal, Que.
Cook & Letch, 558 Beaver Hall Hill, are the general contractors of repairs to warehouse at 81 St. Peter St., costing $14,000, for Estate O. Fisher, 560 Sherbrooke West.

Steel is going up on $15,000 warehouse being built corner Atwater and Centre, for Sherwin Williams Co. Anglin Norcross, Ltd., are the general contractors. Architects, T. Pringle & Sons, Ltd.

Mimico, Ont.
Foundations are in for $10,000 theatre being built here. R. Herod & Son, Mimico Beach, are the general contractors. Carpentry and roofing by owner W. J. McClintock, Lake Shore Rd., who buys material. Masonry by general contractors. Painting, plastering, electric, plumbing and heating to be let.

Ottawa, Ont.
The following sub-trades have been let on $14,000 garage being built on Wellington St. for D. Charlebois, 691 Wellington St., electric—Mr. Donelly, care general contractor. J. B. Daust, plumbing and heating—M. Archambault, Hull, P. Q.; plastering—N. Normand, St. Patrick St. Painting by daywork.

H. Dagenais, 158 St. Patrick St. has been awarded the general contract for factory to be built on Murray St. for I. H. Plant, Ltd.

J. D. Sanderson Co., have the contract for roofing of $25,000 garage machine shop and power house owned by the Ottawa Electric Ry. Co. Masonry, John Sutherland, [illegible] Pickards & Abra. Plumbing and electric by owners.

Ridgeway, Ont.
[illegible] house for Cherry Hill Club. Robertson-Cataract Co., Buffalo, N. Y., have the contract for electrical work, and C. Cald-

Toronto, Ont.

[illegible] et al [illegible] Norman [illegible] Demarco [illegible] Thompson [illegible] Spadina Ave and Queen St [illegible] St General con[illegible] 167 Yonge St [illegible] Spadina Ave

[illegible] W have [illegible] contract for alterations to [illegible] Yonge St [illegible] Construction Co, Ltd.

[illegible] Kendal Ave is the [illegible] for $15,000 store and [illegible] Dundas and Centre [illegible] plastering, [illegible] and electric trades [illegible] Dundas [illegible] Swartz, [illegible]

[illegible] mills are going up for $15,000 [illegible] contract for 121 Yonge St, [illegible] 1216 St Clair [illegible] are architect 346 Dundas [illegible] general contractor Plaster[illegible] and plumbing to [illegible]

[illegible] up in connection [illegible] of club house for Park[illegible] Geo L Robinson, 107 [illegible] Ave has the contract for car[illegible] work. Architects, Molesworth, [illegible] & Secord, Toronto

Vancouver, B. C.

[illegible] & [illegible] 2nd Sixth Ave E, [illegible] general contractors for $24,000 [illegible] to be built at 1118-20 [illegible] St Roofing contract has been [illegible] Gas Co

[illegible] Sinder & Son, 198 Hastings St [illegible] the general contract for $12,000 pat[illegible] and [illegible] factory for John Manufac[illegible] [illegible] W Banks, 755 Georgia St [illegible] the contract for electrical [illegible] Plastering trade not yet let

Windsor, Ont.

[illegible] are plans in for $35,000 [illegible] for Canada Bank of [illegible] Commerce. The following sub-trades [illegible] are required—[illegible] Russell [illegible] Co, Ltd, [illegible] Canadian [illegible] Co Wetherald general con[illegible] are Dufour Construction Co, Ltd Toronto Architect Kennedy & [illegible] Bank Hall Hill Montreal [illegible]

[illegible] Co, Ltd, have the general [illegible] for $50,000 addition to Chipman [illegible] Architect W J Cuthbert, [illegible] [illegible] to be let [illegible] [illegible]

Residences

Hamilton, Ont.

[illegible] [illegible] [illegible] [

ney, is preparing plans of shops and residences to be built on Charlotte St., at a cost of $16,000. Owner is J. Hamburg, Glace Bay, N. S.

Toronto, Ont.

Chas. V. Burrows, 11 Berkamond Ave., is owner of $10,000 residence to be built at 20 Douglas Drive, and is receiving tenders for general contract for entire building. 2 stories, 32 x 28, brick construction.

N. J. Lascombe, 55 Keystone Ave., is the owner and builder of 2 pair residences, $7,000 pair, west side Kingston Rd., near Queen East. Masonry by day labor. Plumbing, heating, painting, plastering and electric to be let by owner.

Foundations are going in for 4 pairs residences, $30,000, east side Rosethorne north east corner Turnberry. Jas. Craig, 156 Oakwood Ave. is the owner and builder, and employs own staff.

Foundations are going in for $15,000 duplex residence, south side Grimthrope Ave. near Atlas. Owner and builder is S. A. Griffin, 48 Vimy Ridge Ave. Tenders are being received on sub-trades. Architect, D. H. Burnham, 260 Lauder Ave.

Excavation work is to start shortly for 7 bungalows, $5,000 each, on Runnymede Rd. Owner and builder is A. Galbraithe, 344 Runnymede Rd. Architect, D. H. Burnham, 260 Lauder Ave. Plumbing, heating, painting, plastering and electric to be let. Masonry by day labor.

Work is to start at once for 2 bungalows, $5,000 each, south side Poulton Ave., near Monarch Park. R. G. Sprague, 775 Coxwell Ave., is the owner and will let plastering, painting, heating, electric and plumbing trades.

B. Swartz, 336 Dundas W., is preparing plans of block stores and apartments to cost $45,000, corner St. Clair and Northcliffe Blvd. Rapid Building Construction Co., 77 Queen W., are the owners. Tenders for this work will shortly be called.

Tenders are being received by the architect, Benj. Swartz, 336 Dundas W., on all trades in connection with stores and apartments, $12,0000, south side Bloor West, near Parkside Drive, for B. Douglas, 117 D'Arcy St.

Piers are in for 8 residences, $1,500 each, south side Cranbrooke Ave., near Elm Road. Wm. Archer, 46 Soudan Ave., is the owner and builder. Tenders are being received on electric, plastering, heating, painting and plumbing.

Excavation work is being done for $9,000 residence corner Edith Drive and Orchard View Blvd. Wm. A. Scott, 58 Edith Drive, is owner and builder. Plumbing, heating, painting, plastering and electric to be let. Masonry by day labor.

P. L. Speirs, 92 Northcliffe Blvd., is owner and builder of $12,000 residence, east side Dunvegan Rd., near Russell Hill Rd. Tenders are being received on plastering, plumbing, painting, heating and electric.

Wm. Moad, 46 Oakwood Ave., is the owner of $18,000 residence and garage being built north east corner Northcliffe and Rosemount. Tenders are being received on plastering, plumbing, painting, heating and electrical trades.

Work is to start shortly on [illegible] dences, $4,000 each, at [illegible] Ave. Day & Hill, 180 Strathcona Blvd. are the owners and builders. Painting, electric, plastering, plumbing and heating to be let.

Tenders are being received by the owner, Thornton Fyfe, 88 Balmoral Ave., on all sub-trades in connection with 2 residences, $6,000 each, to be built north side Briar Hill, near Avenue Rd.

Tenders are being received by the architect, Benj. Swartz, 336 Dundas W., on all trades for 2 stores and apartments, $20,500, to be built at 3237 Yonge St.

Tenders are being received by the owner and builder, Duncan Monroe, 65 Lawton Blvd., on electric, plastering, heating, painting and plumbing for 8 residences, $5,000 each, being built on west side Oriole Parkway near Orchard View Blvd.

Tenders are being received by the owner, Ed. C. Warren, 88 Glengrove Ave., on electric, painting and plastering for $7,500 residence to be built north side Glengrove Ave., near Heather St. Heating and plumbing not definitely signed.

Excavation work is to start shortly for $10,000 residence on Evelyn Crescent. Jas. MacDonald, 379 Lansdowne Ave., is the owner and builder. Plastering, plumbing, painting, heating and electric to be let.

Tenders are being received till December 14, by the city of Toronto, through C. A. Maguire, chairman Board of Control, for installation of sanitary conveniences in a number of residences. Specifications, etc., at office of Medical Officer of Health, city hall.

Work is to start shortly on 2 pair residences, $7,500 each, north side Robins, near Coxwell Ave. Robt. Muir, 20 Linsmore Crescent, is owner and builder, and will let painting, electric, plastering, plumbing and heating trades. Masonry day labor.

Foundations are going in for 1 pair residences, $7,500, west side Kingswood Rd., near Swanwick Ave. Owner and builder is H. McCaffery, 25 Meagher Ave. Painting, plastering, heating, electric and plumbing to be let. Masonry, by day labor.

Work will start in the spring for 2 residences, $4,000, east side Pullen Ave., near Gerrard E. A. E. Petton, 8 Fairmount Crescent is owner and builder.

Footings are going in for $7,000 residence west side Harvie Ave., near Eglinton. E. Stewart, 69 Rogers Rd., is owner and builder.

S. M. Styles, 19 Normanna Ave., is owner and builder of 2 residences, $3,500 each, east side Earlscourt Ave., near Hatherley. Plastering, plumbing, electric, heating and painting to be let.

Footings are going in for $7,000 residence north side Ostend Ave., near Windermere. J. M. Bentley, 517 Runnymede Rd., is owner and builder, and employs regular staff.

Excavation work is being done for 2 residences, $9,500 each, north side Dundurn Ave., near Barrie Ave. F. I. Blackmore, 1057 Davenport Rd., is the owner and builder. Masonry and carpentry work by day labor. Tenders are being received on plastering, plumbing, electric, heating and painting.

[illegible] Ave. [illegible] owner and builder [illegible] residence, $9,200 each [illegible] Rd. near Spruce Ave. Electric, plastering, plumbing and heating to be let.

Wm. R. Warrington, 17 Lascelles Blvd., is owner and builder of 2 residences, $8,500 each, east side Spruce Ave. near Caden Rd., and will let plumbing, heating, painting, electric and plastering trades. Carpentry day labor.

Vancouver, B. C.

J. S. Shriver, 1815 11th Ave. W., is owner and builder of $7,500 residence on 32nd Ave. Electric, painting, heating, plastering not yet let.

R. T. Perry, 101 Lorden Building, is preparing plans of $7,000 residence to be built on 2800 block, 6th Ave. W., for F. W. Smelts. Tenders for this work will be called shortly.

Verdun, Que.

D. Rolland, 103 Second Ave., is owner and builder of $14,000 residence on Third Ave. Masonry, roofing, electric, plumbing, plastering and painting trades to be let.

Foundations are in for $9,000 residence on Second Ave. A. St. Laurent, 167 Gordon Ave., is the owner and builder and will let masonry, millwork, roofing, electric, plumbing, plastering and painting. No materials purchased.

F. X. St. Armour, 326 Mullarky Ave., is owner and builder of $11,000 residence here. Masonry, roofing, electric, plumbing, plastering and painting to be let. Carpentry day labor. No materials purchased.

Excavation work is being done for $7,000 residence on Second Ave. Owner is O. Mongeau, 1002 Verdun Ave., and will let masonry, roofing, electric, plumbing and plastering trades. Carpentry, painting and glazing by day labor.

L. Deschenaux, 1191 Evelyn, is owner and builder of $6,000 residence on Second Ave. Masonry, roofing, electric, plumbing and plastering to be let. Carpentry, painting and glazing by day labor.

Winnipeg, Man.

Foundations are going in for $10,000 residence on Wolseley Ave. Lunat Engineering Co., Ltd., are the owners and builders, and will sublet trades.

CONTRACTS AWARDED

Hamilton, Ont.

[illegible] 19 [illegible] Ave. [illegible] the contract for plastering, and Mc. Morrison, [illegible] for painting and heating, for $15,000 stores and apartments on Main east between Dunsdale and Kenilworth. Peter Hay is owner and general contractor. H. J. Magladen [illegible] Main East.

(Continued on page 55)

Tenders and Proposals

Official Notices by Governments, Municipalities, Architects and Engineers

Hydro Electric Power Commission of Ontario

[illegible] Rt and [illegible] tenders, [illegible] M. R. [illegible] bridge over [illegible] Ont., [illegible] Hydro Electric Power [illegible] Toronto, [illegible] University Avenue, [illegible] to A.M.,

December 13th, 1923.

[illegible] Hydro Electric Power Commission of Ontario [illegible] Chief of Office [illegible]

W. W. POPE,
Secretary.

[illegible] 1923. 49

Tenders for Concrete Arch Bridge

COUNTY OF PETERBORO

[illegible] will be received by H. M. [illegible] Clerk, Clerk [illegible] up to 2 p.m.

Tuesday, January 22nd, 1924,

[illegible] of a concrete arch bridge at [illegible] Ont.

The bridge consists of 2 open spandrel arch [illegible] 110 and 84 [illegible] with 20' railway and [illegible] 6" sidewalk. The [illegible] estimated quantities of [illegible] being [illegible] cu. yds.

Intending bidders are advised to see the site [illegible].

Plans and specifications may be seen at the [illegible] the County Clerk at Peterboro, the [illegible] Clerk at Lakefield and the Undersigned.

A certified cheque or bank draft for 5% of the [illegible] must accompany it as [illegible] to good faith.

The lowest [illegible] not necessarily accepted.

A. W. CONNOR & CO.,
County Engineers,
74 Victoria St., Toronto.

[illegible]

FOR SALE

Ten Ton Holt Caterpillar Tractor

For sale at [illegible] bargain, as [illegible] new rubber tread for same. [illegible] No. 407, Contract Record, [illegible] 44 Tf

RATES

20 cents per agate line (14 lines to the inch). Position Wanted 1 cent per word per insertion. Positions Vacant 2 cents per word per insertion. Box number 10 cents extra. Advertisements for this Section must be received not later than noon on Tuesday to ensure insertion in Wednesday issue.

DEPARTMENT OF RAILWAYS AND CANALS, CANADA.
WELLAND SHIP CANAL

Section S

Notice to Contractors

Sealed tenders addressed to the undersigned and marked "Tenders for Section S, Welland Ship Canal," will be received at this office until 12 o'clock noon, on

Thursday, December, 27th, 1923,

Plans, specifications and form of contract to be entered into can be seen on or after this date at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, and at the office of the Engineer in Charge, Welland Ship Canal, St. Catharines, Ont.

Copies of plans and specifications may be obtained from the Department on the payment of the sum of fifty dollars. To bona fide tenderers this amount will be refunded upon the return of the above in good condition.

An accepted bank cheque on a chartered bank of Canada for the sum of $550,000 made payable to the order of the Minister of Railways and Canals, or War Loan Bonds of the Dominion of Canada to the same amount or War Loan Bonds and cheques if required to make up the difference, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for the work at the rates stated in the offer submitted.

The cheque or bonds thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque or bonds of the successful tenderer will be held as security or part security for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By Order,
J. W. PUGSLEY,
Secretary.

Department of Railways and Canals,
Ottawa, November 29th, 1923. 49-50

Drums for Wire Rope

Where a grooved drum is used for [illegible] rope, and the rope wound more [illegible] one layer, the pitch of the grooves [illegible] should be not more nor less than 1/8 in [illegible] larger than the rope diameter, this will [illegible] give an ideal winding condition for the [illegible] first layer, if the fleet angle is not too [illegible] great, and will permit a good groove [illegible] formation for the second layer. If the [illegible] pitch is too small it is apt to cause [illegible] crowding or rubbing of one wrap of rope against the other, and if a second or third layer is added on a close-pitch groove drum the additional layers of rope will be subject to severe abrasion. The grooves should also be made of a slightly larger radius than the rope, so that the rope will not wedge or pinch in the groove.

TOWNSHIP OF ETOBICOKE

Sanitary Sewer

Sealed tender [illegible] marked as to contents will be received up to 5 o'clock P.M. of

Friday, December 14th, 1923,

for the supplying and laying of approximately 1400 feet of 8 inch sewer.

Plans and specifications may be seen and form of tender obtained at the Township offices, Islington, on or after Monday, December 10th, 1923.

The lowest or any tender need not necessarily be accepted.

N. MacNICOL,
Township Engineer,
Islington, Ont.

49

Water Used for Motor Fuel

The Manchester Guardian Commercial, in the issue of October 25th, gives particulars of an automatically operated device which enables water to be used, as an admixture of petrol, for motor fuel. The water is used in the form of superheated steam and the exhaust manifold of the engine is used to vaporise the liquid and superheat it. In this form it passes to a special carburetter, which is the basic feature of the device. To this carburetter both petrol and steam feed are connected. On starting, the power is given by petrol fed through a slow-running jet, and this petrol is electrically assisted to vaporise quickly. The result is that the mixture can be brought into action within eleven seconds.

Novel Method of Shipping Locomotives

A novel expedient has been adopted by Sir W. G. Armstrong, Whitworth and Co., Limited, in shipping to India seventeen locomotives in such a condition that they are almost ready for immediate service. In fact, the only dismantling necessary before the engines were put aboard the steamer was the removal of the buffers. Some of the locomotives were stowed in the holds and the remainder on deck, under waterproof covers. Engines have, of course, been dispatched in this manner to continental and Irish ports, but never before for such long voyages. The advantage to the purchaser is obvious, as the locomotives can start their useful life much sooner than if they have to be re erected abroad.

Residences

CONTRACTS AWARDED

(Continued from page 53)

Kemptville, Ont.

Dominion Concrete Pipe Co., Ltd., have the general contract for $7,000 residence to be built on Thomas St., for Edith S. Anderson. No materials purchased.

Louiseville, Que.

Jos. Desrosiers, Louiseville, has the general contract for $6,000 residence to be built on Notre Dame St., for Ferdinand Lessard, Ste. Ursule St. Electric, plumbing and plastering to be let.

London, Ont.

Watson & Holmes, 798 Adelaide St., are the general contractors for $15,000 store and apartment to be built on Dundas St. E. Mrs. T. Wolfe, 759 Dundas St., is the owner.

Mount Royal, Que.

E. Tremblay, 13 Perrault Lane, has the contract for roofing, plumbing and heating of four residences, $30,000 being built for Model City Housing Co., Montreal. General contractor is Bruno St. Pierre, 3148 Henri Julien Ave., Montreal.

Montreal, Que.

Foundations are in for 3 residences, $15,000, on Denormanville, between De Fleurimont and Bellechasse, for F. Tremblay & Cie, 400 Williams. J. Cody, 2934 Drolet, has the general contract. Millwork by owners. Roofing, electric, plumbing, plastering, painting and glazing to be let.

Richardson Simard & Co., 745 Clarke St., has the contract for roofing of $12,500 residence on Dunlop Ave., for J. V. D. Annette, 1727 Hutchison. Cook & Leitch are the general contractors.

H. R. Cassidy, 255 Regent St., has the contract for electric work on $20,000 residence on Courte, between Fort and Chomedy, for J. R. Douglas, Canada Cement Building. Painting and glazing to be let. General contractor is A. K. Hutchison, 10 Cathcart St.

F. Chartier, 251 Fullum St., has the roofing contract on $15,000 residence being built on Chateaubriand, between Belanger and St. Zotique. E. P. Belair, 159 Dufresne, is owner and builder.

Work is in progress for repairs costing $25,000, to residence at 443 University St. Following sub-trades have been let: structural steel—Phoenix Bridge & Iron Works, Ltd.; electric—Vincent & Say Electric Co. Masonry by general contractors, Purdy & Henderson Co., Ltd. Millwork, plastering, painting and glazing to be let. Architects, Ross & MacDonald.

Trimming interior is now being done on $150,000 apartment house on Dorchester St. Nard Construction Co. are the owners and builders. Roofing, Dominion Sheet Metal Works; masonry—R. Corrodo, care owners.

Allard & Cie, 558 Adam St., are the general contractors of $8,000 residence on LaSalle, between Notre Dame and Ste Catherine, for C. Robitaille, 43 Cote Place D'Armes. Brickwork—D. Savard, 713 Letourneux. Roofing, electric, plumbing, plastering, painting and glazing to be let.

A. Bailcau, 818 Champagneur, has the general contract for store and residences, total cost $15,000 to C. Wall, corner Juliette and Ontario St. E. Dr. Jeffrey, care architect. J. A. Hayle, 55 St. Francois Xavier, trades to be let.

The following sub-trades have been let on 2 residences, $15,000 being built on St. Valier, between Belanger and Laboau for E. Leonard, 3015 Christophe Colomb, masonry—Cie. Lamontagne, care general contractor; roofing and plumbing—D. Kochenburger, 5749 St. Hubert St.; electric—Mr. Lamm, care general contractor, J. Labelle, 3528 Christophe Colomb. Painting and glazing day labor. Plastering to be let.

New Westminster, B. C.

The following sub-contracts have been let on $20,000 residence on Queen's Ave., for Chas. J. Coulter, 1015 Hamilton St., Vancouver; millwork—R. D. Helmer, 906 Sixth Ave. W.; plumbing—Orr Bros.; painting and glazing—Duncan Campbell, 2277 11th Ave. W. General contractor is J. K. Sinclair. Architects, Townley & Matheson, 311 Ot. Vancouver.

Outremont, Que.

The following sub-trades have been let on $14,000 cottage on Outremont St. Catherine Road; plastering—V. Normand, 3159 Casgrain; tiling—H. Capra, 2795 Drolet; painting and glazing by general contractor, Denis Construction Co.

Gody & Tombini, 2934 Drolet, are the general contractors for $10,000 cottage being built on Dollard Blvd., for Z. Filion, 823 St. Hubert. Brickwork, millwork, roofing, electric, plumbing, heating, plastering, painting and glazing and tiling to be let.

Foundations are going in for 2 flats, $13,000, on Davaar, near McEachran, for R. Buddo, 600 Marquette. D. Abel, 878 McEachran, has the general contract. Sub-trades to be let.

Ottawa, Ont.

J. B. Daust, Carleton, has the general contract altering shop to apartments, $11,000, on Arlington Ave., and is receiving tenders on electric, heating, plumbing and plastering. No closing date set. Balance of work by day labor.

Following sub-trades have been let on $14,000 residence being built on Driveway, for Percy Sparks, 3 Kent St.; electric—H. L. Allen, 272 Bank St.; plumbing and heating—McKinley & Northwood; plastering—Murphy & Morrow; painting—G. Green, Bank and Fourth Ave. Balance of work by day labor.

The walls are going up for 2 residences, $10,000, on Bronson Ave. Following sub-trades have been let; electric—H. L. Allen, 272 Bank St.; plumbing and heating—G. Renwick, care owner; plastering, Mr. Beamont, care owner, Caleb Brookes, 590 Driveway. Painting by day labor.

Oshawa, Ont.

The walls are going up for $7,000 residence on Alma St., for John McMaster, 124 Alma St. D. Powier is the general contractor. Plumbing and heating is being done by Fred Cusot, Grooms Ave.

Three Rivers, Que.

[illegible] the following sub-trades have been let on $150,000 apartment house to be built south west corner Hertel and Ave. and Wellington Crescent, excepting Dufresne Construction Co. brickwork—P. Rodaro, 457 Shaughnessy, carpentry (labor only)—A. Jarzynski, 270 Crawford. Owners, D. Levine, care architect, Laplan & Spratchman, 208 Dundas W.

The following sub-trades have been let on 2 stores and apartments, $12,000, north west corner Yonge and Melrose, masonry—F. & A. E. Ham, 85 Salem Ave., roofing, Toronto Sheet Metal Works, plumbing—Art Key, 54 Arlington Ave., glazing and glass, Consolidated Plate Glass Co. of Canada, Ltd., painting—Geo. West, 721 Rhodes Ave., plastering—F. Morette; carpentry—J. Tait & Co., care architect, Benj. Swartz, 336 Dundas W. Heating to be let.

Howard Furnace Co. have the contract for heating of 2 pair residences, $7,500 a pair, east side Ladykirk, near Fourth Ave. W. Padfield, 69 Chisholm Ave., is the owner and builder and employs own staff for electric, plastering and plumbing. Masonry and painting by day labor.

H. J. Overbough, 211 Oakmount, has the general contract for 2 residences, $4,500 each, north side Cranbrooke Ave., near Elm Road, for Thos. G. Hunthorn, 192 Roselawn Ave. Sub-trades to be let by general contractor.

Following sub-trades have been let on 4 residences, $4,000 each, south side Clements Ave., near Avenue Rd.; carpentry—W. Scott, 33 Cedarvale Ave.; plastering—Kee & Son, 451 St. Clarens Ave.; heating—Peerless Furnace Co., 548 College St.; electric—G. Armstrong, 1217 College St.; painting—W. Chilcott, 965 Lansdowne Ave.

Geo. Franks, 178 Quebec Ave., has the contract for carpentry work, and F. & A. E. Ham, 85 Salem Ave., masonry work, on $12,000 store and apartment at 946 St. Clair W. Tenders on other trades are being received by the architect, B. Swartz, 336 Dundas W.

The following sub-trades have been let on 2 residences, $5,000 each, south side Craighurst Ave., near Roswell Ave.; heating—Wm. Boyd, 18 Austin St.; plastering—Robt. Irving, 191 Lansdowne Ave.; plumbing—Christopher Bros., 20 Astley St. Wm. Rattrel, 105 Sherbourne St., is owner and builder. Painting by day labor.

Foundations [illegible] for 6 pair residences, $7,000 [illegible] Orchard View Blvd. near Duplex Ave. J. Graham, 275 McCall St. has the contract for masonry. Other trades to be let. Greenshaw Bros., 3[illegible] Yonge St. are the [illegible]

The [illegible] have been let on 4 pair residences, $7,000 each

[illegible] Montgomery Ave. and Yonge St. [illegible] Contract [illegible] Contract [illegible] Contract [illegible] Davies Co. [illegible] Ave. Heating [illegible] D. D. [illegible] Montgomery Ave. Tenders are being received [illegible] and [illegible]

[illegible] Contract [illegible] let on [illegible] contract, being [illegible] each, east side [illegible] Drive, near Eglinton Ave., plumbing—Harry Beckly, 219 Wychwood Ave.; heating—L. C. Carstead, 9 Redpath St.; plastering—W. Simpson. Painting [illegible] Chas. W. White, 267 [illegible] St.

[illegible] Contract [illegible] is being done on 1 pair residences, $7,000, north side Castle[illegible] Ave., near Rosewell. Following sub-trades have been let, plastering—Clarke Bros., 203 Bedford Park Ave.; heating—Geo. Nairn, 256 Spadina Ave.; painting—Geo. Moore, Bedford Park Ave.; painting—R. J. Greenway, 28 [illegible] Ave.; electric—Horton & Dowdle. Owner and builder, Godfrey R. Webb, 70 Orchard View Blvd.

[illegible] are going up for $8,000 residence, north side Glen Grove Ave., near Dawlish, for Mrs. Margaret Abbott.

SUPPLY BONDS
CITY OF TORONTO

If you have been awarded a supply contract by the City of Toronto, you will be asked to furnish a bond of a Surety Company.

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FIDELITY AGENCY OF CANADA

[illegible] Agincourt Ave. F. Foley, 141 Lansdowne Ave., is doing the masonry work. Other sub-trades to be let by general contractor, F. Waite, 745 Euclid Ave. Architects, J. Hunt Stanford & Son, 67 Yonge Arcade.

Following sub-trades have been let on 1 pair residences, $6,000 a pair, on east side Henning, near Eglinton Ave.; plumbing—J. Walker, 88 Malvern Ave.; heating—L. C. Carstead, 9 Redpath St.; plastering—C. F. Pritchards, 98 Dawes Rd.; masonry—Wm. Roberts, 179b Coxwell Ave. Painting by day labor. Owner and builder is Geo. Nicholson, 6 High Park Gardens.

R. B. Royle, 147 Ascot Ave., has the plastering contract on $10,000 residence being built at 209 Glencairn Ave. Painting day labor. Owner and builder is A. L. Sanagan, 3 St. Leonards Ave.

Excavation work is in progress for 1 pair residences, $7,000, north side Gerrard E., near Hollywood Crescent. Owner and builder is A. Cornell, 127 Normandy Blvd. Masonry work has been let to Mr. Alderstead, 12 Osborne Ave.

The following sub-trades have been let on 7 residences, $4,300 each, west side Hemlock Ave.; electric—T. B. Kilner, 601 Jones Ave.; plumbing—W. J. Merrill, 862 Kingston Rd.; heating—Toronto Furnace Co. Painting by day labor. Owner and builder is Fred Lankin, 223 Fulton Ave.

Following sub-trades have been let on $7,000 residence being built north side Alexandria Blvd.; electric—E. Warman, 209 Soudan Ave.; plumbing and heating—W. R. Willis, 189 Broadway Ave. Plastering and painting to be let. F. Markham, 156 Alexandria Blvd., is owner and builder.

C. P. Manning, 88 Walmsley Blvd., is the builder of $7,000 store and apartment south side Eglinton Ave., near Pitman Ave. Owner is Henry S. Griffin, New York City. Masonry, day labor.

F. Imber, 136½ Ferrier Ave., has the painting contract for $19,000 residence west side Russell Hill Rd., near Coulson Ave. Ed. H. Yeigh, 2 Bloor West is the general contractor. A. A. Brayley, 75 Crescent Rd., is the owner.

Foundations are going in for $25,000 residence and garage north side Kilbarry Ave. near Warren Rd. Bayview Electric Co. have the contract for electrical work. Heating and plumbing by owner, G. Booth, 214 Heath St. Plastering and painting by day labor. Tiling to be let. Walter Oborne, 144 Glengrove Ave. E., is the general contractor.

The foundations are in for $10,000 residence and garage south side Rochester Ave., near St. Ives, for J. W. Scott, 576 Church St. Geo. A. Clark, 115 Glengrove Ave., is the general contractor; masonry—Thos. Roden, 51 Goodwood Ave. Tenders are being received by owner on electric, plumbing, heating, tiling, painting and plastering. J. Hunt Stanford & Son, 67 Yonge Arcade, are the architects.

Thos. Roden, 51 Goodwood Ave., has the contract for masonry, and John Sheard, 1908 Dufferin St., the plumbing contract, on $7,500 residence being built at 104 Alexandria Blvd. Tenders are being received by the owner and builder, Geo. A. Clark, 115 Glengrove Ave., on tiling, electric, painting and plastering.

J. D. Brown, 288 Davenport Rd., has the painting contract on $20,000 residence being built on Dunvegan Rd., for G. S. Homestead, care architect, J. Mitchell, 55 Isabella St. All trades to be let.

Foundations are going in for $12,000 residence and garage north side Laurence Crescent, near Mt. Pleasant Rd.; for F. C. Carter, 60 Victoria St. Ireland Bros., 14 Dunnek Crescent, are the builders. Masonry day labor.

Vancouver, B. C.

University Plumbing Co., Ltd., have the contract for plumbing and heating in connection with alterations for $270,000 apartment block on Georgia St. General contractors are Booker, Campbell & Whipple; architect, H. S. Griffith.

Windsor, Ont.

G. Campeau, 831 Wyandotte St. E., has the contract for electric work, and White Plumbing & Heating Co., the plumbing and heating, on $8,000 duplex residence being built on London St., lot 6, for J. H. Rodd, Sandwich, Ont. Plastering and painting to be let. Sam Keyser, 1312 Victoria Ave., is the general contractor.

White Plumbing & Heating Co. have the contract for plumbing and heating $8,500 duplex residence being built on London St., for J. H. Rodd, Sandwich, Ont. Sam Keyser, 1312 Victoria Ave., is the general contractor. Electric, plastering and painting to be let.

Winnipeg, Man.

Lount Engineering Co. have the general contract for $8,500 residence being built on Wolseley Ave. foot of Basswood, for Mrs. W. A. McKim, 1179 Wolseley Ave. General contractor buys materials and sub-lets trades.

Power Plants, Electricity and Telephones

Niagara Falls, Ont.

Queen Victoria Park Commission propose a lighting system at a cost of $20,-

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SIDNEY W. BAND
Asst. General Manager
W. R. KIRKPATRICK
Canadian Secretary

BURLINGTON STEEL COMPANY, LIMITED

HAMILTON CANADA

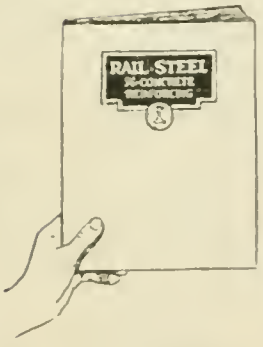
Specifications

A steel specification is a document for guidance to the manufacturer in producing an article, and a protection to the purchaser in accepting it. A specification should be written only after careful study of the production of the article, and an equally careful study of the use to which it is to be put.

Specification A-16-14, covering Rail Steel Bars, was issued by the American Society for Testing Materials only after the most careful investigation that has ever been made of any reinforcing material. In 1913, Professor W. K. Hatt, then of Purdue University (now on Mr. Hoover's staff) made over 3,000 tests on as many samples obtained under normal working conditions from four separate mills. Professor Hatt found that Rail Steel Bars had unusual strength, and furthermore, "excess ductility for its strength above usual grades of steel."

Specification A-16-14 is, therefore, everything that a specification should be. It is a protection to the purchaser. It assures him of getting Rail Steel Bars, proven by over 3,000 tests to have a quality factor (strength and ductility) in excess of usual grades of steel. This specification at the same time prevents any substitution of undesirable re-rolled material.

Specify your reinforcing steel to meet A.S.T.M. specifications A-16-14, or equal



You will be interested in the facts contained in this valuable book. A copy is yours for the asking.

Burlington Reinforcing Bars used in construction of Warehouse for Crane Limited, Toronto, erected 1922

Anglin-Norcross, Limited, General Contractors

Wm. Steele & Sons, Architects

Sturtevant

Successful Buildings

include a first-class, up-to-date Heating and Ventilating System. For not only does adequate heat and proper ventilation provide comfort and good health to the occupants, but it also assures longer life to the building with a minimum upkeep and repair expense.

Sturtevant Heating and Ventilating Systems have been installed and operated with distinctive success in practically all types of buildings. Folder 606, containing many interesting details, illustrations of equipment and buildings where installed, will be mailed without charge. Ask for your copy now.

B. F. Sturtevant Company
of Canada, Limited.

Montreal Galt Winnipeg Toronto

000. 2 batteries will be installed, 1 on table rock ledge and one on roof of Ontario Power Co. plant, to illuminate Niagara Falls. Work will start in the spring. Mr. Bond is the engineer in charge.

An addition to lighting system costing $30,000, on Niagara River Parkway from Administration Building to Dufferin Island, is being arranged by the Queen Victoria Park Commission.

Surrey, B. C.

B. C. Telephone Co., Ltd., of Vancouver, contemplate building a telephone exchange in Surrey Municipality, near Newton.

Toronto, Ont.

The walls are going up for $160,000 sub station south east corner Danforth Ave. and Morton Rd., for Toronto Electric Commissioners. Roofing, painting and plastering trades to be let. General contractors are Jackson-Lewis Co., Ltd.

Verchers, Que.

South Shore Heat & Power Corp., contemplate extension to transmission line from Ste. Julie to Richelieu River. Work will probably go ahead next spring.

Weston, Ont.

The walls are going up for $40,000 telephone exchange being built here. F. G. Roberts & Co., 106 Wells St., have the contract for painting. Wells & Grey, Ltd, Toronto, are the general contractors.

CONTRACTS AWARDED

Godbout, Que.

St. Regis Paper Co. of Canada, Ltd., Montreal, Que., have awarded the general contract in connection with their $100,000 hydro electric development, to Canadian Comstock Co., Ltd., of Montreal. Contract includes installation of water wheels, generators, penstock, transmission lines, pumps, motors and electrical distributors.

Montreal, Que.

Laying of floors is now being done for $1,500,000 addition to telephone exchange, corner Ontario and St. Urbain Sts. Following sub-trades have been let: roofing — Douglas Bros. Co., Ltd.; plumbing, heating and ventilating—Garth & Co., Ltd.; ornamental iron—John Watson & Son, Ltd.

Miscellaneous

Chatham, Ont.

Additional contract for strengthening of wall and reconstruction of damaged portion, in connection with renewal of revetment wall costing $15,000, has been awarded to Wm. Bermingham, Kingston, Ont., at $3,300.

CONTRACTS AWARDED

Craven, Sask.

C. G. Anderson, Regina, Sask., has been awarded the contract for the erection of a dam here at $6,567.85

Ingonish, N. S.

The contract for reconstruction of breakwater has been awarded to Thos. D. Morrison, D'Escousse, at $21,572.

KIRKFIELD
CRUSHED STONE and LIMESTONE DUST

New Address

THE CRUSHED STONE LIMITED
Harland Smith Building
53 Adelaide St. West
TORONTO

Elgin 1780
Elgin 1620

Audited, Verified Circulation!

is only
available on the National
Building and Engineering Paper:

Contract Record
and Engineering Review

Thirty-Seven Years of
Continuous, Meritorious Service

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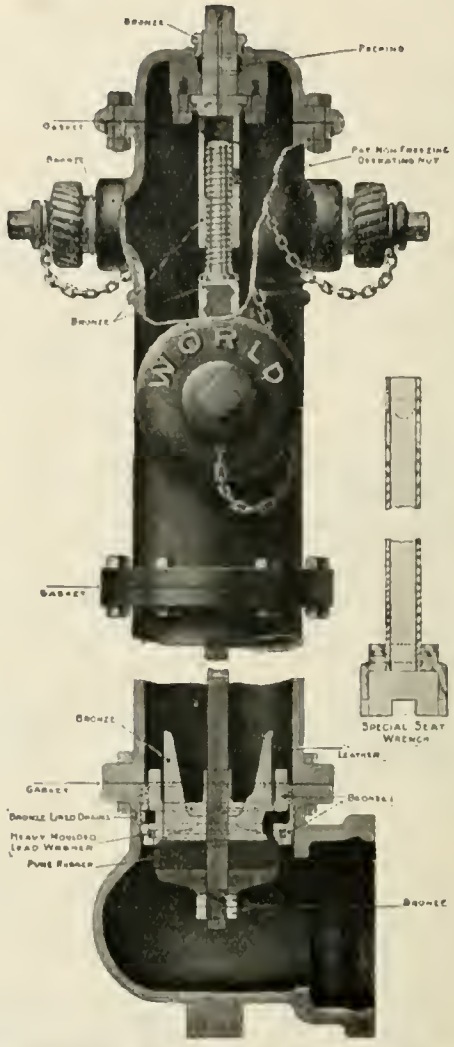
"World" Fire Hydrants and Gate Valves

"WORLD" Hydrants and Valves have been the choice of engineers and municipal officials for nearly one hundred years. Today they are in service in every province in Canada and their numbers increase steadily.

Only products of exceptional merit could boast such a record.

"World" Hydrants are "right"—in design, in materials, in workmanship. Make them your choice and you'll never have cause to regret it.

Catalogs, prices and full details are yours for the asking.



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TRADE WORLD MARK

M'AVITY'S GUARANTEE

"Demand The Brand"

J. M'Avity & Sons. Ltd.

Valves Fittings & Supplies

Goods Guaranteed Good by Almost a Century's Experience Estd. 1834

St. John, N.B. Canada.

Cypress St., Point Grey, Vancouver, B. C. This street, Tarvia since 1919, is in perfect condition today.

"We Couldn't Write a Better Advertisement for Tarvia"

UNDER the date of July 6th, 1923, Mr. W. B. Greig, Municipal Engineer of Point Grey, Vancouver, B. C., writes as follows:

> "The re-surfacing of Matthews Avenue between Angus Avenue and Cypress Street and of Cypress Street northerly from Matthews Avenue, was carried out in 1919 with 'Tarvia—X.'
>
> "The cost of the work did not exceed 80c per sq. yard, inclusive of all material and labor, and the results have been very satisfactory.
>
> "No maintenance repairs of any kind have been necessary to date."

We couldn't write a better advertisement for Tarvia than this.

And hundreds of other communities have found that Tarvia roads are the economical solution of the good roads problem — satisfactory alike to road officials and ratepayers.

For Tarvia roads are not only firm, smooth, dustless and mudless all the year round—they are far less costly to build and maintain than any other type of modern highway. Because of these economies, the use of Tarvia insures the most miles of good roads that can possibly be built and maintained with the road funds available. There is a grade of Tarvia for every road purpose—new construction, repairs or maintenance.

Write to our nearest office for practical information regarding your road problem.

Tarvia

For Road Construction Repair and Maintenance

The Barrett Company LIMITED

MONTREAL TORONTO WINNIPEG

VANCOUVER ST. JOHN, N. B. HALIFAX, N. S.

MELDRUM
IRONWORKS
Limited

130 Van Horne Ave. Montreal
Calumet 3697
Representatives:
W. H. Noonan, B. Sc., Halifax
Adolphe Huot Limited, Quebec

Tenders

A few dollars spent in advertising your proposals in

The Contract Record

would result in additional competition which might save your city or town or your client many hundreds of dollars.

Washed Sand and Gravel
If You Build—Build Safely

Use clean, well graded sand and gravel of a superior quality.

A. W. ROBERTSON
Limited
Engineers and Contractors
Plant: Ivanhoe, Ont. Post Office, Telephone and Telegraph: Tweed, Ont.

New Roads From Old

The Wise Engineer makes the utmost of the old material in the road he is repairing and uses

The Austin Road Scarifier

to loosen the good stone before adding a bond of new surface material

This powerful Scarifier tears up the high or the uneven road surface to a depth of from two to four inches, and loosens effectively the low parts or "potholes," as well. This reduces the irregularities to an even bed on which to roll and form the new crust—the new stone bonding with the old perfectly, in a most economical manner.

Our nearest branch will gladly mail you valuable and interesting Austin road-building facts and costs of equipment.

THE Canadian FAIRBANKS-MORSE Co., LIMITED

St. John Quebec Montreal Ottawa Toronto Windsor Winnipeg Regina
Calgary Vancouver Victoria

149

For Permanent Construction

Use

Pressure Creosoted Wooden Materials

PILING
POLES
CROSS-ARMS
FENCE POSTS
PAVING BLOCKS
"BLOXONEND" FLOORS
STORM SEWERS
FACTORY ROOFS
RAILROAD TIES
BUILDING LUMBER
MINE TIMBERS
HOT HOUSE LUMBER

If you could be assured of an annual saving of 50% to 80% in cost of maintenance, would it not be worth while to ask us to furnish you with authentic data as to the relative longevity of pressure treated and untreated materials?

Our Engineering Department is at your service.

Practise conservation that really conserves.

CREOSOTED PRODUCTS Ltd.

C.P.R. Building
Toronto, Ont.
Phone: Adel. 3604

For Road Building and Construction Work

Select your requirements in Crushed Stone, Gravel Lime, Cement, Sand, Etc,

—from—

BRITNELL & COMPANY, LIMITED

C.P.R. Crossing **Yonge Street** **North Toronto**

Day Phone, North 664 **Night Phone, North 2107**

Current Prices of Building and Engineering Materials

	Toronto	Montreal	Winnipeg	Vancouver
CEMENT (Delivered on job):—				
[illegible] delivered .....per bbl.	$4.60	$4.16	$5.00	$4.30
[illegible] including bags, f.o.b. siding .....per bbl.	3.45*	3.48	4.20	4.20
Refund on bags .....each	.20	.20	.20	.20
LIME				
Lime, in retail lots, delivered .....per ton	14.30	13.00	.58 bu.	2.70 bbl
Lime, in car lots f.o.b. siding .....per ton	11.80	9.50	13.80 ton*	2.60 bbl
Hydrated, white in retail lots, delivered .....per ton	20.00	26.00	.63 bag†	22.00
Hydrated, white in car lots, f.o.b. siding .....per ton	18.00	21.00	.56 bag†	18.00
Hydrated, grey in retail lots, delivered .....per ton	18.75	19.00		
BRICK and TILE (Delivered on job):—				
Common face brick .....per M	24.00	16.50*	19.00	23.00
No. 1 dry pressed brick .....per M	30.00	30.00	36.00	65.00
No. 2 dry pressed brick .....per M	28.50	25.00	32.00	
Enamelled brick .....per M	125.00 up	180.00	185.00	150.00
Wire cut brick, for foundation work .....per M	21.00	19.00		40.00
Sand lime brick .....per M	17.00		18.00	19.00
Hollow building tile .....per M			8-12c. per ft.	105-240.00
Paving brick imported .....per M	on appl.	100.00	55.00	60.00
Fire brick .....per M	68-95	60-75	85-100	70.00
Fire clay .....per ton	13-20	15-16.00	35.00	20.00
STONE, SAND and GRAVEL (f.o.b. cars on siding):—				
Crushed stone, 2 in. .....per ton	2.05**	1.80	2.45 yd.*	$2.75 yd.
Crushed stone, 1 in. and under .....per ton	2.31	1.90	2.75 "	" "
Crusher run .....per ton	2.20½		3.00 "	" "
Rubble stone .....per ton	2.45	1.70	15.00 cord	" "
Gravel, 2 in. screened .....per ton	1.84		2.45 yd.	" "
Gravel 1 in. screened .....per ton	2.05	1.50	2.75 "	" "
Sand, screened .....per ton	1.26½	1.25	1.90 yd.	2.50 yd.
Pit run .....per ton	1.52¾	1.25	1.90 "	" "
STEEL and IRON (f.o.b. warehouse):—				
Mild steel bars, ¼ in. and heavier .....per 100 lbs	3.90 base†	4.00 base	4.90	4.00
Bands 3/16 in. and lighter .....per 100 lbs	4.40 "	4.50 "	5.40 base	
Hoops .....per 100 lbs	5.00 "	5.00 "		
Angles, channels and tees under 3 in. .....per 100 lbs	4.50 "	4.00 "	5.45	6.00
Structural shapes .....per 100 lbs.	4.25 "	4.25 "	5.35 base	6.00
Plates—¼ in. and heavier .....per 100 lbs	3.75 "	3.90 "	5.45	6.25
Plates—3/16 in. .....per 100 lbs	4.25 "	4.25 "	5.85	6.50
Plates—10 gauge .....per 100 lbs.	4.60 "	4.50 "	6.15	6.50
Black sheets—28 gauge .....per 100 lbs	5.60 "	5.00 "	6.50	8.25
Galvanized sheets—28 gauge .....per 100 lbs.	6.75 "	7.00 "	7.85	9.35
Galvanized Corrugated sheets—28 gauge .....per 100 ft.	7.00 "	7.00 "	7.70	8.25-8.50
Rivets .....per 100 lbs.	6.25 "	6.00 "	7.50 base	
Cast iron pipe .....per ton	67.50	60.00 "		
VITRIFIED CLAY PRODUCTS (Delivered on job):—				
Sewer pipe, 4 in. .....per ft	.40	.30	.35	.25
Sewer pipe, 6 in .....per ft.	.60	.45	.40	.35
Sewer pipe, 8 in. .....per ft.	.80	.70	.60	.45
Sewer pipe, 9 in. .....per ft.	1.00	.85	.70	.60
Sewer pipe, 10 in. .....per ft.	1.20	1.05	.80	.55
Sewer pipe, 12 in .....per ft.	1.50	1.35	1.00	.65
Sewer pipe, 15 in .....per ft.	2.25	1.80	1.85	.95
Sewer pipe, 18 in. .....per ft.	3.00	2.50	2.45	1.50
Sewer pipe, 21 in .....per ft.	4.00	3.00		1.90
Sewer pipe, 24 in .....per ft.	6.00	4.50	3.75	3.10
Tile wall coping, 8 or 9 in .....per ft.	60	.50		.50
Tile wall coping, 12 or 13 in. .....per ft.	.90	75		.60
Flue lining, 8½ x 8½ in. .....per ft.	.70*	.60	.55	.40
Flue lining, 8½ x 13 in .....per ft.	1.00*	.90	.65	.75
Chimney tops .....each	9.00	14.00	7.50	4.50–6.00
Discounts	45 % truck lots 50 % car lots	20 % 50 %	5 %	

CEMENT—*Discount of 5% †Bag of 80 lbs
BRICK AND TILE—*Net, plant
STONE, SAND AND GRAVEL—*Winnipeg prices subject to 5% discount **Toronto prices include sales tax.
STEEL—*Large [illegible] were advanced recently. New list may be had on application to dealers
VITRIFIED CLAY PRODUCTS—Discount on flue linings is 55%

DAKE MACHINERY

Compact—Simple—Reliable

Hoists, Winches, Cranes, Motors, Fans, Blowers, Pumps, Swingers, Marine Machinery etc., etc. Air, Steam or Electric to suit your convenience.
Let us quote you on your requirements. Send for our Big Catalogue of Dake Machinery. Let our Engineers assist you to your mechanical problems.

Dake Engine Company, Grand Haven, Mich.

Canadian Office 502 Kent Building, Toronto, Ont.
Capt. Wm. Stitt, Can. Sales Mgr.

In Stock

STEAM SHOVELS

Revolving and Railroad Type

LOCOMOTIVES

Standard, 36" and 24" Gauge

CARS

Ballast; 20 yard; 6 yard; 4 yard; 3 yard; and 2 yard

DERRICKS, HOISTING ENGINES
AIR COMPRESSORS, RAILS

Eastern Equipment Co.

Limited

MONTREAL, QUE. P. O. Box 792 DORVAL, QUE.

RAILS

New 12 to 105 lb. complete with Fastenings, Bolts, Spikes, Switches, Tie Plates and etc.

Relaying Rail, 20 to 100 lbs.

John J. Gartshore Limited

58 Front St. West, Toronto

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Russell Construction

Company, Limited

Engineers and Contractors

Harbor Administration Building

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Buildings, Bridges, Dock and Harbor Work

Specialists in

Pile Driving

ESTIMATES FURNISHED

"On our Terminal job we poured about 30,000 yards of concrete. Our Clyde derrick kept our hoppers supplied at all times at a considerable saving and never caused us a moment's delay. JACOBSON BROS., Duluth."

Every unit of the CLYDE line of Hoisting equipment is built to fixed quality standards and is covered by rigid guarantees against original defects. Write for information.

You'll take pride in your CLYDE!

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DULUTH, MINN., U. S. A.

Sole Distributors for Clyde Iron Works

NEW YORK CHICAGO NEW ORLEANS JACKSONVILLE SEATTLE MEMPHIS CINCINNATI PORTLAND

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued

Lumber (Delivered on job):—	Toronto	Montreal	Winnipeg	Vancouver
Flooring, 1 x 3 and 4 in., clear, E. G. fir ....per M.	100.00	60.00	80.00	63.00
Flooring, 1 x 3 and 4 in., clear, F. G. fir ....per M.	75.00	65.00	56.00	43.00
Flooring, No. 1 pine ....per M.	75.00	80.00		
Flooring, No. 1 Spruce ....per M.	52.00	45.00		
Flooring, birch and maple, 13/16 in. clear ....per M.	130.00	110.00	156.00	200.00
Flooring, plain red oak, ⅜ in. clear ....per M	120.00	125.00	136.00	265.00
V joint, 1 x 3 and 4 in., Nos 1 and 2, clear, fir ...per M.	75.00	65.00	56.00	45.00
V joint, No. 1 pine ....per M.	75.00	85.00	63.00	
Pine, 1 x 4 to 12 in., common rough ....per M.	46/61	45.00	40.00	
Red and Jack Pine, 2 x 4 to 12 in., com. rough per M.	48/58	70.00	36.00	
Hemlock, 2 x 4 to 12 in ....per M	41/45	40.00	36.00	11.50-18.75
Fir, 1 x 4 to 12 in. No 1 common, D 1 S ....per M	45/60	50.00	35.20	20.00/25.00
Spruce, 1 and 2 x 4 to 12 in. ....per M	48/60	45-35	36.00	
Timbers, fir, 10 x 10 in. and up ....per M	65.00	58.00	53.60 base	17.-22.00
Lath, No. 1 white pine ....per M.	13.50	12.00	11.20	
Lath, M. R. spruce ....per M.	9.50	8.50	8.40	7.00
Shingles, XXX B.C. cedar ....per M.	6.00	5.00	5.60	3.25
XX B.C. cedar ....per M.	4.50	4.25	3.20	1.90
N.B. extras ....per M.	6.50	6.75		
N.B. clears ....per M.	6.00	5.50		
Pine casing ....per M.	1 ct. per in.	95.00	115.00	55.00
Fir casing ....per M.	1¼ ct. per in.	100.00	105.00	70.00
PAINTS, OILS, COLOURS (delivered):—				
White lead ground in oil, less than ton lots ....per cwt.	13.25	14.60	15.60	16.30
Red lead, dry, small lots ....per cwt.	17.00	9.55	22.00	16.00
Putty in bulk ....per cwt.	5.95	4.25	5.25	7.75
Steel sash putty in bulk ....per cwt.	6.45	6.00	8.00	7.75
Boiled linseed oil, in bbls. ....per gal.	1.20	1.40	1.30	1.46
Raw linseed oil, in bbls. ....per gal.	1.17	1.38	1.33	1.43
Turpentine, in bbls. ....per gal	1.50	2.20	1.70	2.25
Mortar Color, maroon, in bbls. ....per lb.	.02¼		.06 9/10	6.45 per cwt.
Mortar Color, black, in bbls. ....per lb.	.08		.06 4/5	.45
PLASTER (Delivered):—				
Hard wall plaster, sanded ....per ton	13.50	15.00	26.00	26.00
Plaster of paris, in bbl. lots ....per bbl.	5.50	5.35	1.60 bag*	7.50
Plasterers' hair ....per bag	2.50	7½ cts. per lb.	1.00 bu*	-.50
LABOR:—				
Bricklayers ....per hr.	1.00	.80–.90	1.10	1.06¼
Structural Iron Workers ....per hr.	.85	.50–.75	.90	1.00
Plasterers ....per hr.	1.25	.80	1.07½	1.06¼
Hoisting Engineers ....per hr.	.70–.80	.50	.85-1.00	1.00
Plumbers ....per hr.	.90	.60–.75	1.00	.90
Carpenters ....per hr.	.90	.65	.85	.81¼
Painters ....per hr.	.75	.55–.65	.75	81¼
Electrical Workers ....per hr.	.80	.65	.65- .85	1.00
Roofers ....per hr.	.65	.65	.50	.90
Laborers (Common) ....per hr.	.40–.50	.30	.42½	.50-.56¼
Laborers (Skilled) ....per hr.	.60-.70			.90
Sheet Metal Workers ....per hr.	.80			

PLASTER—*Including bags. † 10c. extra for bags.

Wire Brompton Your Interior Finish Needs

And don't be afraid to mark your order "RUSH". We have all the facilities for making immediate delivery, no matter what size your next order. Try us on a mixed carload.

HARDWOOD FLOORING OUR SPECIALTY.

Brompton Lumber & Mfg. Co. **Bromptonville, Quebec**

THE HAGERSVILLE CRUSHED STONE Co.

Crushed stone from our quarries is hard and durable, giving lasting service with least upkeep costs. Does not deteriorate with exposure to weather and does not cost any more than softer stone. Approximate weight 2400 lbs. to cubic yard, which means a big saving in freight over gravel products.

Capacity of Plant: 25 Cars Per Day

Prompt shipment. Delivery on all steam and electric railways. Your orders solicited.

Phone 19, Office: MAIN ST., HAGERSVILLE, Robt. Hambleton, Mgr.

Largest and Best Equipped Plant in Ontario

As evidence of our desire to give customers the highest grade product and the best service, we have installed the most modern equipment known to the industry.

A daily output of 3500 tons is being achieved and the stone, all sizes, comes clean and even in size.

Write, wire or phone your orders for quick action

Canada Crushed Stone Corporation Limited

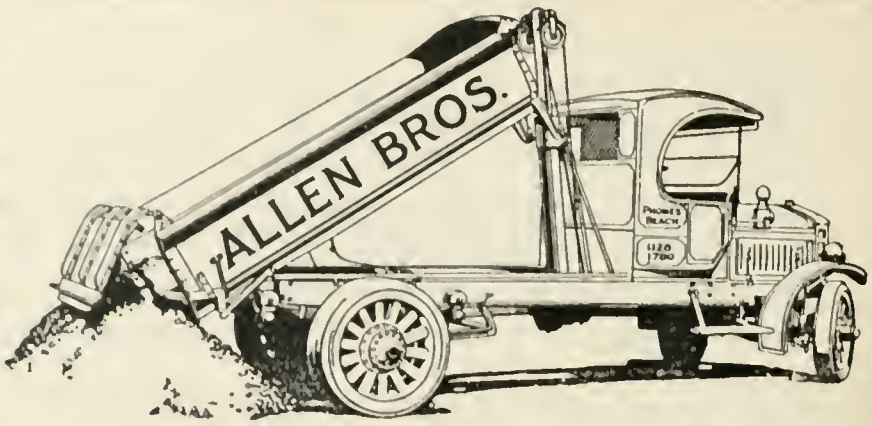
DUNDAS ONTARIO

Exclusive Agents:—John E. Russell Co., Ltd. **Phone Adelaide 1600**

SCREEN GRAVEL
PEA GRAVEL
SAND

Rapid Truck Delivery. Just Phone
Beach 1128 or 1780

ALLEN BROTHERS
STOP 19, KINGSTON ROAD
TORONTO, ONT.



GREENBURN
SAND & GRAVEL CO. LTD.

WASHED SAND and GRAVEL
WASHED CONCRETE SAND
CONCRETE PRODUCTS

33 ADELAIDE ST. W., TORONTO, ONT.
Phones: Office, Adel. 4936 Nights, Ger. 4049M

Wire Rope and Fittings

FOR ALL PURPOSES
Have you a copy of our catalogue?
We fabricate Iron Work for builders. Send us your specifications.
Canada Wire & Iron Goods Co. HAMILTON
Wire rope stocks carried in Montreal, Calgary and Edmonton
Agents J. H. Hanson, Co. Ltd., Montreal
N. F. Judah, McLeod Bldg., Edmonton

Install the Tank With the Most Advantages

THE steel tank provides the only safe source of water supply for fire protection purposes.
A tank that may burn reduces by a considerable margin the degree of safety inherent in a fire protection system. A tank that may burst due to deteriorated hoops or rotted staves may put a sprinkler system out of service at the critical moment of fire against which a fire protection system may have been maintained for years. A tank which leaks results in a continual expense and may reduce the available water storage at critical times.
To all of these difficulties in the way of reliable fire protection, the Horton steel tank is the logical solution.
The Horton steel tank cannot burn; it cannot rot; it is scientifically designed with proper factors of safety to prevent any chance of failure; it will not leak; and it provides a dependable supply of water depending on the force of gravity alone to make it instantly available in case of fire.

Horton Steel Works Ltd.
BRIDGEBURG, ONT. 106 Janet Street
MONTREAL, QUE. 1005 Bank of Toronto Bldg.

CRUSHED STONE LIME SAND

STANDARD LIME COMPANY LIMITED

JOLIETTE, QUE.

LARGEST PRODUCERS OF LIME IN CANADA

PLANTS

CRUSHED STONE
JOLIETTE, QUE.
C.N.R. & C.P.R.

LIME
JOLLIETTE and ST. MARC, QUE.
C.N.R. & C.P.R.

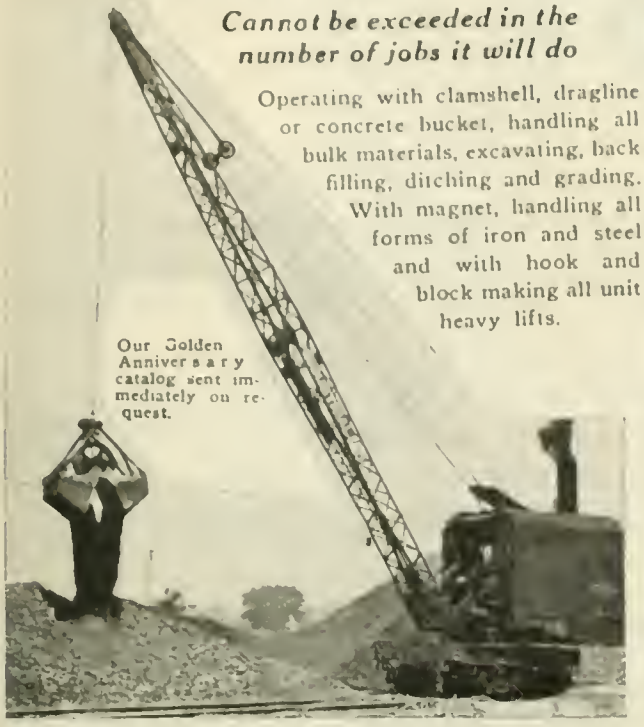
SAND
ST. FELIX DE VALOIS, QUE.
C.P.R.

AN INDUSTRIAL CRANE

Cannot be exceeded in the number of jobs it will do

Operating with clamshell, dragline or concrete bucket, handling all bulk materials, excavating, back filling, ditching and grading. With magnet, handling all forms of iron and steel and with hook and block making all unit heavy lifts.

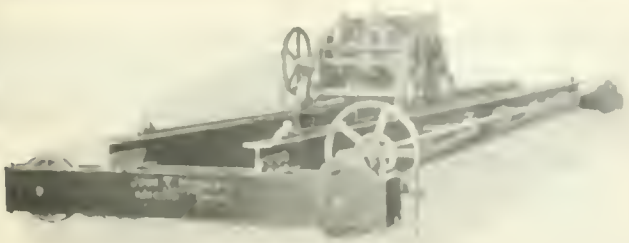
Our Golden Anniversary catalog sent immediately on request.



INDUSTRIAL WORKS BAY CITY MICHIGAN

1873 Builders of Cranes for 50 years 1923

Canadian Agents:
F. H. HOPKINS & CO. LTD.,
Montreal Toronto



Overhead Cranes

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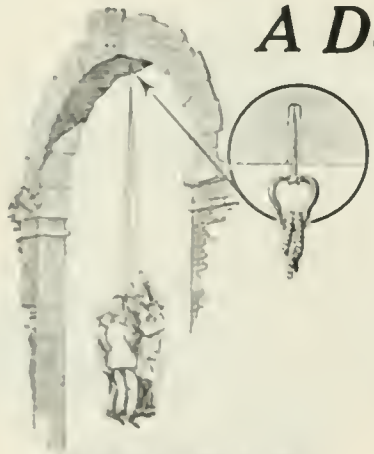

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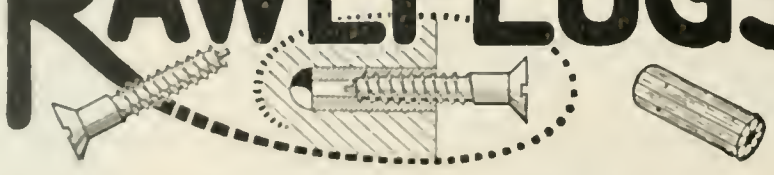

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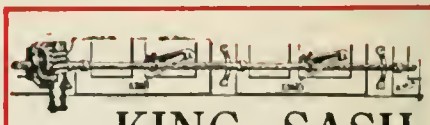
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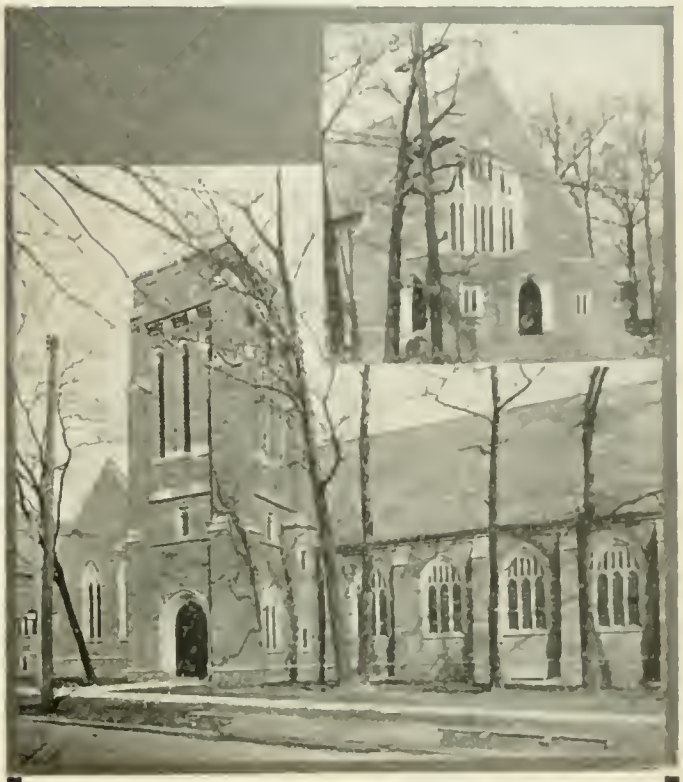

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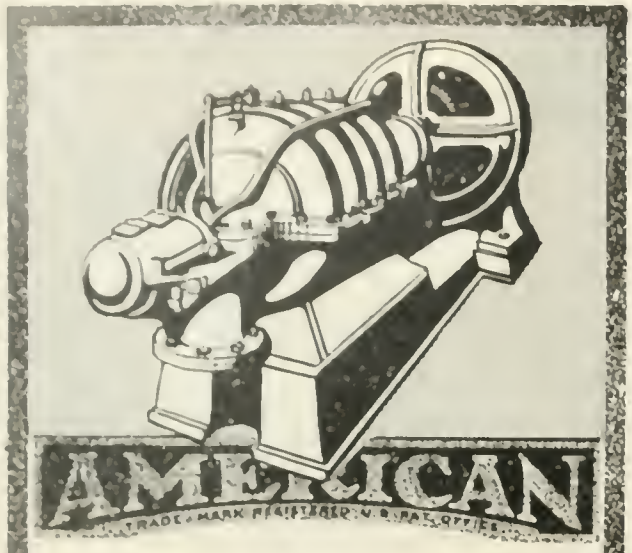

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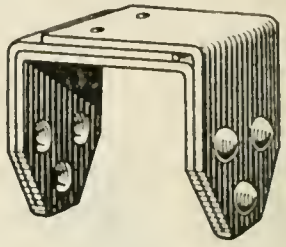

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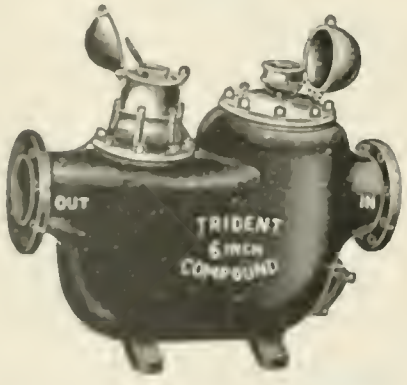

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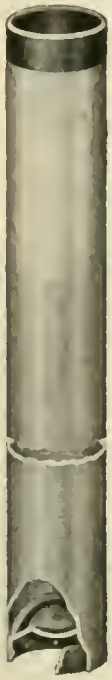

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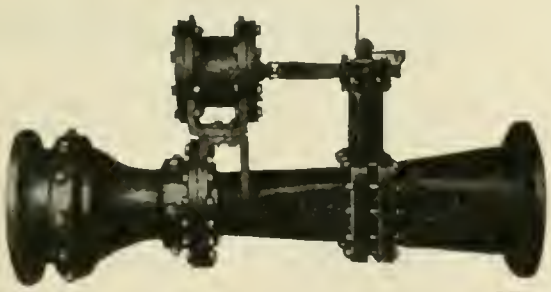

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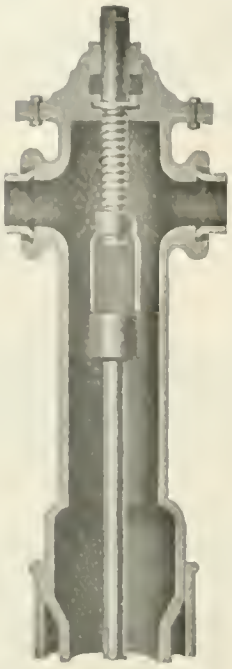

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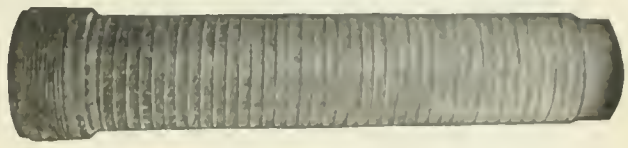

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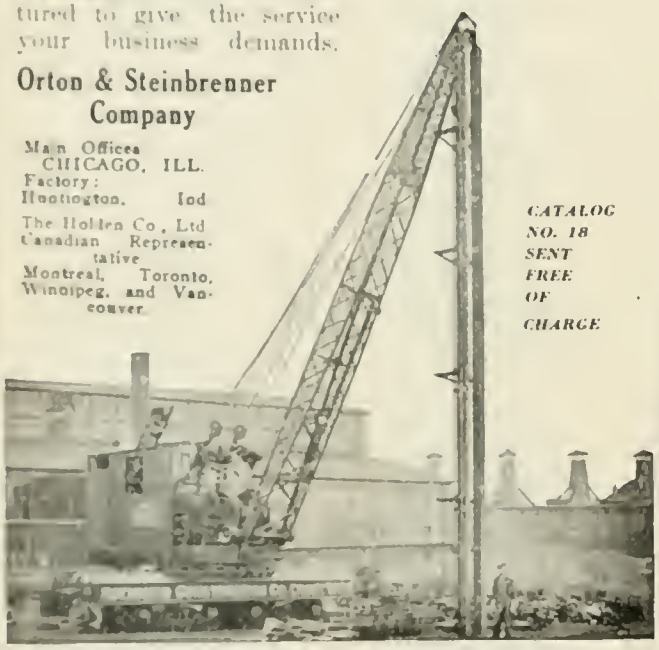

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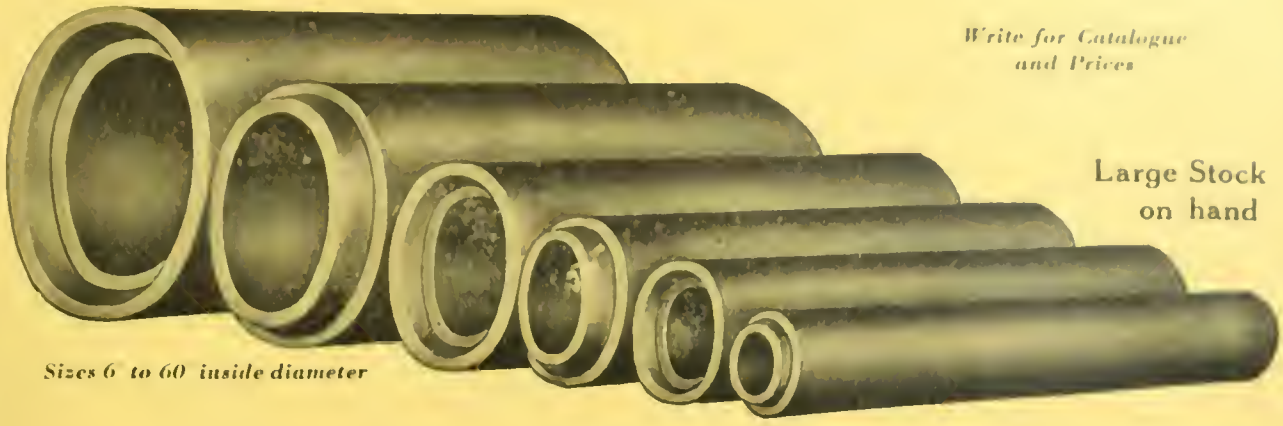

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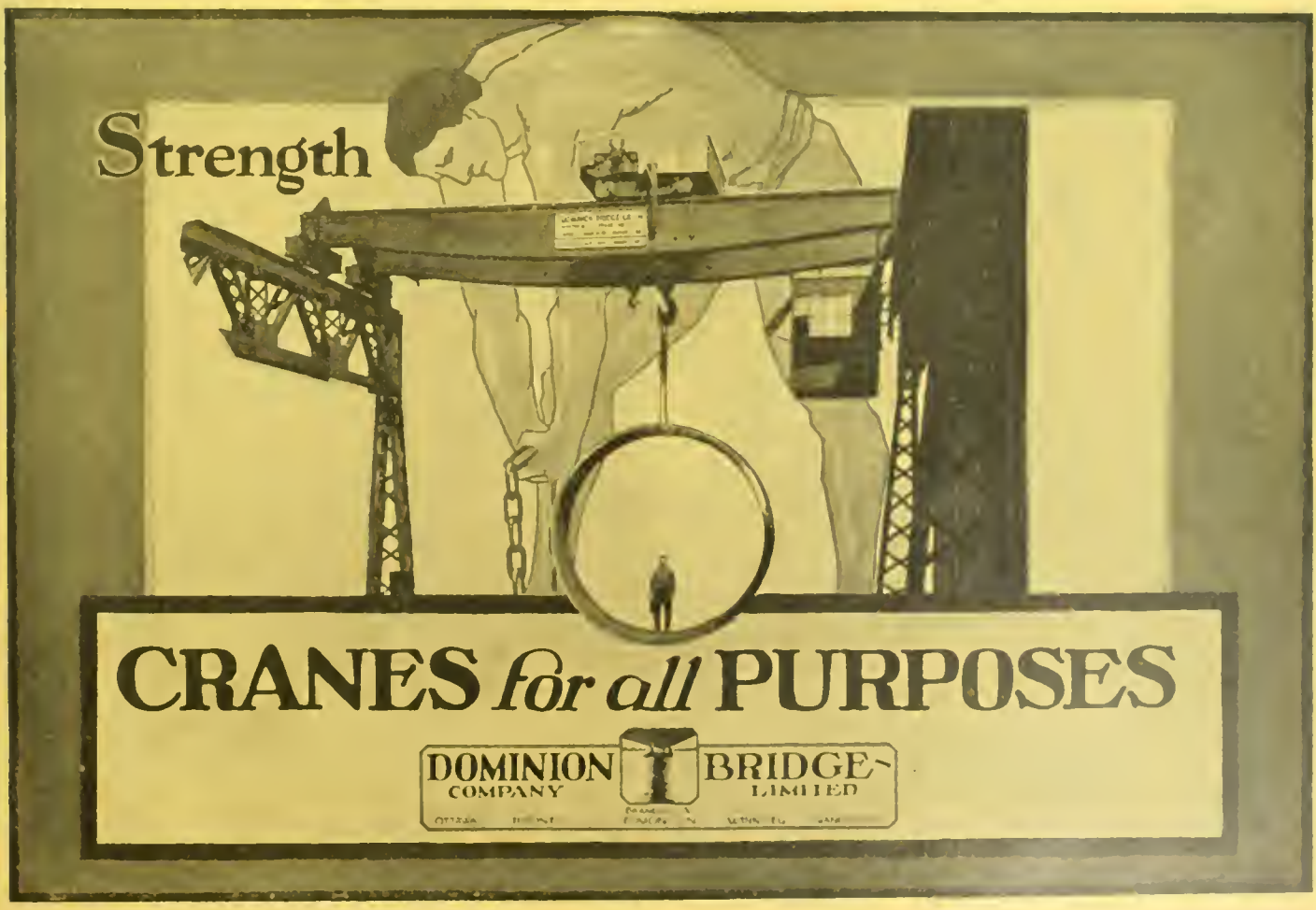

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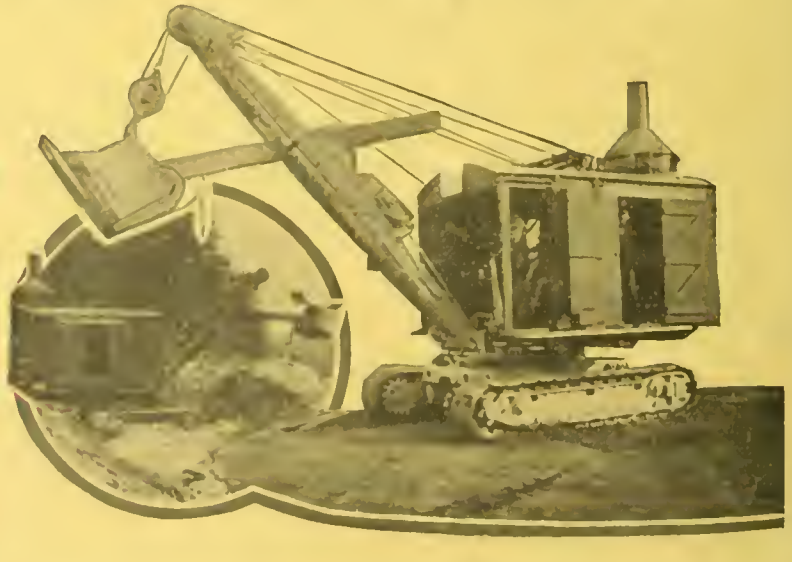

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